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IS 13159-1 (1993): Pipe Flanges and Flanged Fittings, Part 1: Dimensions [MED 17: Chemical Engineering Plants and Related Equipment]

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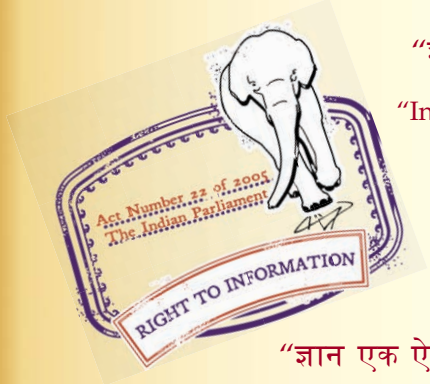

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IS 13159 (Part 1) : 1993

(Reaffirmed 1999)

भारतीय मानक

पाइप फ्लैंज और फ्लैंजदार फिटिंगें — विशिष्टि

भाग 1 आयाम

Indian Standard

PIPE FLANGES AND FLANGED FITTINGS — SPECIFICATION

PART 1 DIMENSIONS

UDC 621·643·412

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

December 1993

Price Group IS

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Chemical Engineering Plants and Related Equipments Sectional Committee had been approved by the Heavy Mechanical Engineering Division Council.

This standard is being prepared in two parts. Part 2 of this standard shall cover the materials of construction dimensions of gaskets and other design considerations.

In this standard, flanges of all ratings, flanged fittings of all ratings and flanged fittings (base type) of all ratings are grouped together for basic convenience to user.

The pipe size designations and dimensions are given in Annex A.

In the formulation of this standard, assistance has been derived from:

a) ANSI B 16.5-1981 'Pipe flanges and flanged fittings', issued by the American National Standards Institute;

b) IS0 2229 'Equipment for the petroleum and natural gas industries — Steel pipe flanges nominal size 1/2 to 24 in — Metric dimensions' issued by the International Organization for Standardization (ISO);

c) MSS SP-25 'Standard marking systems for valve fittings, flanges and unios' issued by the Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. USA; and

d) MSS SP-9 'Spot facings for bronze, iron and steel flanges', issued by the Manufacturer's Standardization Society of the Valve and Fittings Industry Inc. USA.

Till such time the Part 2 of the standard is available the material designations in Table B 2 to B 8 are given as per ANSI system for guidance and easy implementation of the standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PIPEFLANGESAND FLANGED FITTINGS — SPECIFICATION

PART 1 DIMENSIONS

1 SCOPE

This standard covers dimensions, tolerances, marking, testing and methods of designating openings for pipe flanges and flanged fittings in sizes DN15 to DN600. Flanges and flanged fittings may be cast or forged. Blind flanges and reducing flanges without hubs may also be made from plate. Pressure-temperature ratings tables are given in Annex B for various materials. The ratings are applicable for type and form of fittings as mentioned above.

A flange or flanged fitting used under the Indian Boiler Regulation will be subjected to any/all limitations of that regulation. This includes any maximum temperature limitation, rule governing the use of a material at low temperature or provisions for operation at a pressure exceeding pressure temperature ratings given in this standard.

2 REFERENCES

The following Indian Standards are necessary adjuncts to this standard:

IS No.	*Title*
2825 : 1969	Code for unfired pressure vessels
3138 : 1966	Hexagonal bolts and nuts (M42 to M150)
3333 (Part 1): 1967	Dimensions for petroleum industry pipe threads: Part 1 Line pipe threads

3 PRESSURE TEMPERATURE RATINGS

Flanges and, flanged fittings shall be designated as one of the following:

PN 20, PN 50, PN 68, PN 100, PN 150, PN 250 and PN 420.

Class 150, Class 300, Class 400, Class 600, Class 900, Class 1500 and Class 2500.

4 SIZE

The size of a flange or flanged fitting or bolt covered by this standard is its nominal diameter.

USC of 'nominal' indicates that the stated dimension is only for designation, not measurement. The actual dimension may or may not be the nominal size and is subjected to established tolerance. Dimensions of flanges shall be as per Tables 1 to 7 read with Fig.1 depending on rating of flange.

4.1 Fitting shall be desginated by the size of the opening in their proper sequence as indicated in Fig. 2.

4.2 Reducing flanges shall be designated by the two nominal pipe sizes. See example in Note 3 of Table 8.

5 MARKING

5.1 General

5.1.1 *Location and Method of Applying Marking*

All required markings shall be cast, fdrged or stamped upon the exterior of the product.

5.1.2 *Permissible Omission of Marking*

On flange of small size which will not permit all required markings, they may be omitted to the degree which conditions require. The sequence of omission shall be:

a) Size,

b) Melt identification,

c) Rating,

d) Conformance,

e) Ring-Groove number,

f) Material, and

g) Indication of source of manufacture.

5.2 Source of Manufacture

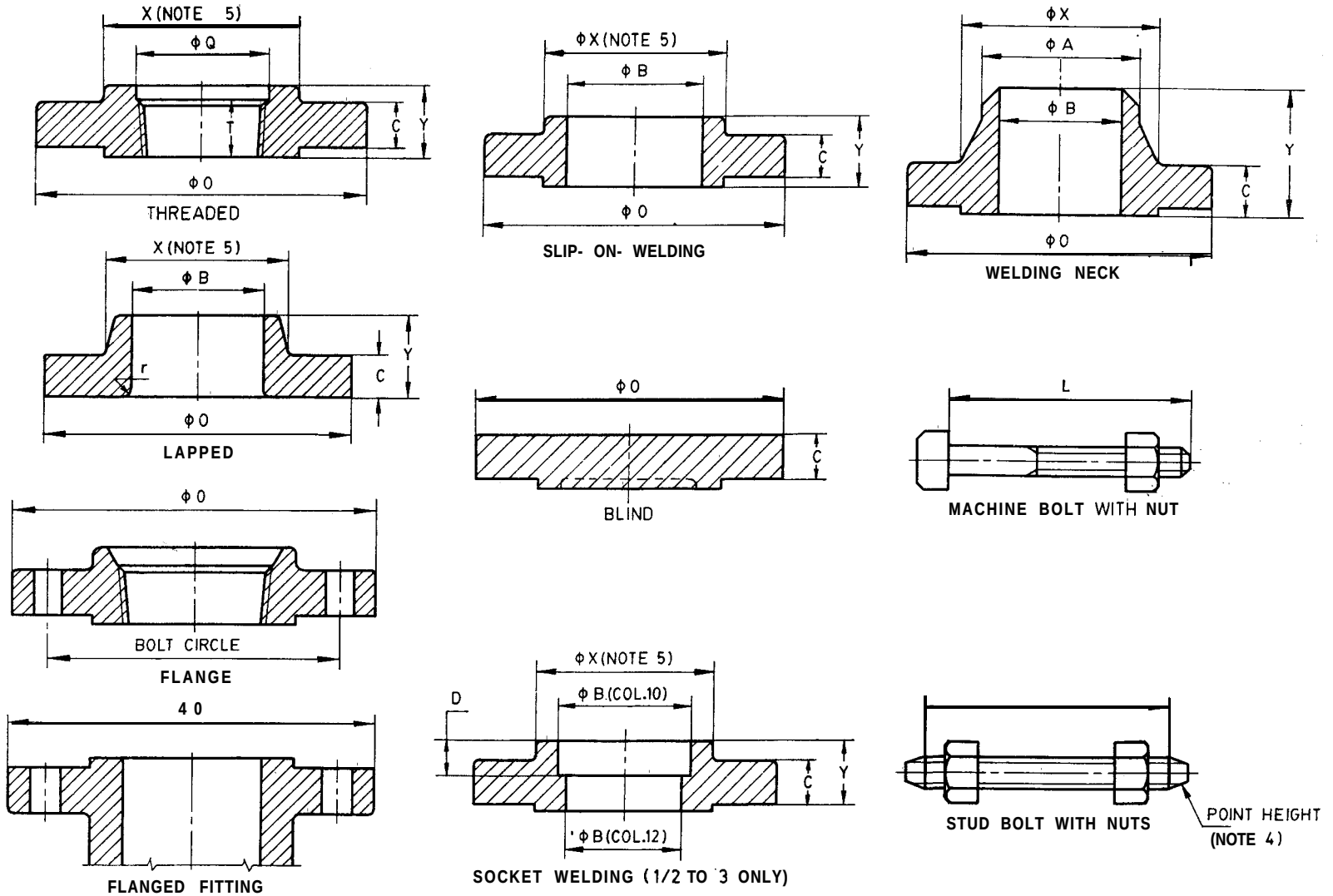
Indication of source of manufacture shall be indicated.

5.3 Material

Flanges and flanged fittings shall be marked with appropriate specification grade identification number and the melt number or melt identification, if any. These mandatory material indications may be supplemented at manufacturer's option with his trade designation for the material grade; but confusion of symbols shall be avoided.

5.4 Rating

Alpha numerals shall be applied giving the pressure rating class for which the product is designed.



NOTE — '*C*' includes raised face for PN 20 and PN50 flanges

FIG. 1 LEGEND KEYS FOR DIMENSIONAL TABLES 1 TO 7

Table 1 Dimensions of PN 20 Flanges

(*Clause* 4 and *Fig.* 1)

All dimeosioos in millimetres.

Nominal Size		Outside Dia of Flange	Thick-ness of Flange *Min*	Dio of Hub	Hub Dia Begin-ning of Chamfer, Welding Neck	Lengtb Through Hub			Thread Length Threaded Flange, *Min*	Bore			Corner Radius of Bore of Lapped Flange and Pipe	Depth of Socket	Drilling				Length of Stud Bolts, *L*		
						Threaded Slip on Socket Welding	Lapped	Welding Neck		Slip-on Socket Weld-ing, *Min*	Lapped, *Min*	Weld-ing Neck Socket Weld-iog			Dia of Bolt Circle	Dia of Bolt Holes	Number of Bolts	Nomi-oal Dia of Bolts	Stud Bolts		Machin Bolts
																			2 mm Raised Face	Ring Joint	2mm Raised Face
DN	NPS	*O*	C	X	A	Y	Y	Y	*T*	*B*	*B*	*B*	*r*	*D*							
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
15	I “ 1/2	90	11.5	30	21.5	16	16	48	16	22	23	16	3	*10*	60.5	16	4	Ml4	60	—	45
20	3/4	100	13.0	38	26.5	16	16	52	16	28	28	21	3	11	7 0 . 5	16	4	Ml4	65	—	50
25	1	110	14.5	49	33.5	17	17	56	18	34.5	35	26.5	3	13	79.5	16	4	Ml4	65	80	55
32	1 1/4	120	16.0	59	42	21	21	57	21	43.5	43.5	35	5	14	89.0	16	4	Ml4	70	80	55
40	1 1/2	130	17.5	65	48.5	22	22	62	22	49.5	50	41	6	16	98.5	16	4	Ml4	70	95	60
50	2	150	19.5	78	60.5	25	25	64	25	62	62.5	52.5	8	17	120.5	20	4	Ml8	80	95	65
65	2 1/2	180	22.5	90	73	29	29	70	29	74.5	75.5	62.5	8	19	139.5	20	4	Ml8	90	100	75
80	3	190	24.0	108	89	30	30	70	30	90.5	91.5	78	10	21	152.5	20	4	Ml8	90	105	75
90	3 1/2	215	24.0	122	101.5	32	32	71	32	103.5	104	90	10	—	178.0	20	8	Ml8	90	105	75
100	4	230	24.0	135	114.5	33	33	76	33	116	117	102.5	11	—	190.5	20	8	M18	90	105	75
125	5	255	24.0	164	141.5	36	36	89	37	143.5	144.5	128	11	—	216.0	22	8	M20	90	110	80
150	6	280	25.5	192	168.5	40	40	89	40	170.5	171.5	154	13	—	241.5	22	8	M20	100	115	85
200	8	345	29.0	246	219	44	44	102	44	221.5	222	202.5	13	—	298.5	22	8	h420	110	120	90
250	10	405	30.5	305	270	49	49	102	49	276	277.5	254.5	13	—	362.0	26	12	M24	115	130	95
300	12	48.5	32.0	365	324	56	56	114	56	327	328	305	13	—	432.0	26	12	M24	120	135	100
350	14	535	35.0	400	355.5	57	79	127	57	359	260	To be specified by the purchaser	13	—	476.0	30	12	M27	130	150	110
400	16	600	37.0	457	406.5	64	87	127	64	410.5	411		13	—	540.0	30	16	M27	135	150	115
450	18	635	40.0	505	457	68	97	140	68	462	462.5		13	—	578.0	33	16	M30	150	160	125
500	20	700	43.0	559	508	73	103	145	72	513	514.5		13	—	635.0	33	20	M30	160	170	135
600	24	815	48.0	664	609.5	83	111	152	80	616	616		13	—	749.5	36	20	M33	175	18.5	145

Table 2 Dimensions of PN 50 Flanges

(Clause 4 and *Fig.* 1)

All dimensions in millimetres.

Nominal Size		Outside Dia of Flange	Thickness of Flange, *Min*	Dia of Hub	Hub Dia Beginning of Chamfer Welding Neck	Length Through Hub			Thread Length Threaded Flange, *Min*	Bore			Corner Radius of Bore of Lapped Flange and Pipe	Counter Bore Threaded Flange, *Min*	Depth of Socket	Drilling				Length of Stud Bolts, *L*		
						Threaded Slip-on Socket Welding	Lapped	Welding Neck		Slip-on Socket Welding, *Min*	Lapped, *Min*	Welding Neck Socket Welding				Dia of Bolt Circle	Dia of Bolt Holes	Number of Bolts	Nominal Dia of Bolts	Stud Bolts		Machine Bolts
																				2 mm Raised Face	Ring Joint	2 mm Raised Face
DN	NPS	*O*	*C*	*X*	*A*	*Y*	*Y*	*Y*	*T*	*B*	*B*	*B*	r	*Q*	*D*							
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
15	1/2	95	14.5	38	21.5	22	22	52	16	22	23	16	3	23.5	10	66.5	16	4	M14	65	75	55
20	3/4	120	16.0	48	26.5	25	25	57	16	28	28	2 1	3	29.0	11	82.5	20	4	M18	75	90	60
25	1	125	17.5	54	33.5	27	27	62	18	34.5	35	2 6 . 5	3	36.0	13	89.0	20	4	M18	80	90	65
32	1 1/4	135	19.5	64	42	27	27	65	21	43.5	43.5	35	5	44.5	14	98.5	20	4	M18	80	95	65
40	1 1/2	155	21.0	70	48.5	30	30	68	22	49.5	50	41	6	50.5	16	114.5	22	4	M20	90	105	75
50	2	165	22.5	84	60.5	33	33	70	29	62	62.5	52.5	8	63.5	17	127.0	20	8	M18	90	105	75
65	2 1/2	190	25.5	100	73	38	38	76	32	74.5	75.5	62.5	8	76.0	19	149.0	22	8	M20	100	115	85
80	3	210	29.0	118	89	43	43	79	32	90.5	91.5	78	10	92.0	21	168.5	22	8	M20	110	125	90
90	3 1/2	230	30.5	133	101.5	44	44	81	37	103.5	104	90	10	105	—	184.0	22	8	M20	110	125	95
100	4	255	32.0	146	114.5	48	48	86	37	116	117	102.5	11	118	—	200.0	22	8	M20	110	130	95
125	5	280	35.0	178	141.5	51	51	98	43	143.5	144.5	128	11	145	—	235.0	22	8	M20	120	135	100
150	6	320	37.0	206	168.5	52	52	98	46	170.5	171.5	154	13	171	—	270.0	22	12	M20	125	140	105
200	8	380	41.5	260	219	62	62	111	51	221.5	222	202.5	13	222	—	330.0	26	12	M24	140	155	110
250	10	445	48.0	321	273	67	95	117	56	276	277.5	254.5	13	276	—	387.5	30	16	M27	155	170	130
300	12	520	51.0	375	324	73	102	130	61	327	328	305	13	329	—	451.0	33	16	M30	170	1 8 5	145
350	14	585	54.0	426	355.5	76	111	143	64	359	360	To be specified by the purchaser	13	360	—	514.5	33	20	M30	175	195	150
400	16	650	57.5	483	406.5	83	121	146	68	410.5	411		13	411	—	571.5	36	20	M33	190	205	160
450	18	710	60.5	533	457	89	130	159	70	462	462.5		13	462	—	628.5	36	24	M33	195	210	170
500	20	775	63.5	587	508	95	140	162	73	513	514.5		13	513	—	686.0	36	24	M33	205	225	180
600	24	915	70.0	702	609.5	106	1 5 2	168	83	616	616		13	614	—	813.0	42	24	M39	230	255	195

Table 3 Dimensions of PN 68 Flanges

(Clause 4 and *Fig.* 1)

All dimensions in millimeters.

Nominal Pipe Size		Outside Dia of Flange	Thickness of Flange, *Min*	Din of Hub	Hub Dia Beginning of Chamfer Welding Neck	Length Through Hub			Thread Length Threaded Flange, *Min*	Bore			Corner Radius of Bore of Lapped Flange and Pipe	Counter Bore Threaded Flange, *Min*	Drilling				Length of Stud Bolts, *L*		
						Threaded Slip-on	Lapped	Welding Neck		Slip-on, *Min*	Lapped, *Min*	Welding Neck			Dia of Bolt Circle	Dia of Bolt Holes	Number of Bolts	Nominal Dia of Bolts	7 mm Raised Face	Male & Female also Tongue & Groove	Ring Joint
DN	NPS	0	c	*X*	*A*	Y	*Y*	*Y*	*T*	*B*	*B*	*B*	*r*	*Q*							
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
15	1/2	Use PN 100 dimensions in these sizes																			
20	3/4																				
25	1																				
32	1 1/4																				
40	1 1/2																				
50	2																				
65	2 1/2																				
80	3																				
90	3 1/2																				
100	4	255	35.0	146	114.5	51	51	89	37	116	117	To be specified by the purchaser	11	118	200	26	8	M24	140	130	140
125	5	287	38.5	178	141.5	54	54	102	42	143.5	144.5		11	145	235.	26	8	M24	145	140	150
150	6	320	41.5	206	168.5	57	57	103	46	170.5	171.5		13	171	270	26	12	M24	150	145	155
200	8	380	48.0	260	219	68	68	118	51	221.5	222		13	222	330	30	12	M27	170	165	175
250	10	445	54.0	321	273	73	102	124	56	276	277.5		13	276	387.5	33	16	M30	190	185	195
300	12	520	51.5	375	324	79	108	136	60	327	328		13	329	451	36	16	M33	205	195	205
350	14	585	60.5	426	355.5	84	117	149	64	359	360		13	360	514.5	36	20	M33	210	205	210
400	16	650	63.5	483	406.5	94	127	152	68	410.5	411		13	411	571.5	39	20	M36	220	215	225
450	18	710	67.0	533	457	98	137	165	70	462	462.5		13	462	628.5	39	24	M36	230	220	230
500	20	775	70.0	587	508	102	146	168	73	513	5 14.5		13	513	686	42	24	M39	245	240	250
600	24	915	76.5	702	609.5	114	159	175	82	616	616		13	614	813	48	24	M45	270	265	280

Table 4 Dimensions of PN 100 Flanges

(*Clause* 4 and *Fig.* 1)

All dimensions in millimetres.

Nominal Size		Outside Dia of Flange	Thickness of Flange, *Min*	Dia of Hub	Hub Dia Beginning of Chamfer Welding Neck	Length Through Hub			Thread Length Threaded Flange, *Min*	Bore			Corner Radius of Bore of Lapped Flange and Pipe	Counter Bore Threaded Flange, *Min*	Depth of Socket	Drilling				Length of Stud Bolts, *L*		
						Threaded Slip-on Socket Welding	Lapped	Welding Neck		Slip-on Socket Welding, *Min*	Lapped, *Min*	Welding Neck Socket Welding				Dia of Bolt Circle	Dia of Bolt Holes	Number of Bolts	Nominal Dia of Bolts	7 mm Raised Face	Male & Female also Tongue & Groove	Ring Joint
DN	NPS	*O*	*C*	*X*	*A*	*Y*	*Y*	*Y*	*T*	*B*	*B*	*B*	*r*	*Q*	*b*							
1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
15	1/2	95	14.5	38	21.5	22	22	52	16	22	23	To be specified by the puchaser.	3	23.5	10	66.5	16	4	M14	80	70	75
20	3/4	120	16.0	48	26.5	25	25	57	16	28	28		3	29.0	11	82.5	20	4	M18	90	80	90
25	1	125	17.5	54	33.5	27	27	62	18	34.5	35		3	36.0	13	89.0	20	4	M18	90	85	90
32	1 1/4	135	21.0	64	42	29	29	67	21	43.5	43.5		5	44.5	14	98.5	20	4	M18	100	90	100
40	1 1/2	155	22.5	70	48.5	32	32	70	22	49.5	50		6	50.5	16	114.5	22	4	M20	105	100	105
50	2	165	25.5	84	60.5	37	37	73	29	62	62.5		8	63.5	17	127.0	20	8	M18	105	100	110
65	2 1/2	190	29.0	100	73	41	41	79	32	74.5	75.5		8	76.0	19	149.0	22	8	M20	120	115	125
80	3	210	32.0	117	89	46	46	83	35	90.5	91.5		10	92.0	21	168.5	22	8	M20	125	120	130
90	3 1/2	230	35.0	133	101.5	49	49	86	40	103.5	104		10	105	—	184.0	26	8	M24	140	130	140
100	4	275	38.5	152	114.5	54	54	102	41	116	117		11	118	—	216.0	26	8	M24	145	140	150
125	5	330	44.5	189	141.5	60	60	114	48	143.5	144.5		11	145	—	267.0	30	8	M27	165	160	165
150	6	356	48.0	222	168.5	67	67	117	50	170.5	171.5		13	171	—	292.0	30	12	M27	170	165	175
200	8	420	55.5	273	219	76	76	133	57	221.5	222		13	222	—	349.0	33	12	M30	195	185	195
250	10	510	63.5	343	273	86	111	152	65	276	277.5		13	276	—	432.0	36	16	M33	215	210	220
300	12	560	66.5	400	324	92	117	156	70	327	328		13	329	—	489.0	36	20	M33	220	215	225
350	14	605	70.0	432	355.5	94	127	165	73	359	360		13	360	—	527.0	39	20	M36	235	230	235
400	16	685	76.5	495	406.5	106	140	178	78	410.5	411		13	411	—	603.0	42	20	M39	255	245	255
450	18	745	83.0	546	457	117	152	184	79	462	462.5		13	462	—	654.0	45	20	M42	275	265	275
500	20	815	89.0	610	508	127	165	190	82	513	514.5		13	513	—	724.0	45	24	M42	290	280	305
600	24	940	102.0	718	609.5	140	184	203	92	616	616		13	614	—	838.0	52	24	M48	330	320	330

Table 5 Dimensions of PN 150 Flanges

(*Clause* **4** and Fig. 1)

All dimensions in millimetres.

Nominal Size		Outside Dia of Flange	Thickness of Flange, *Min*	Diameter of Hub	Hub Dia Beginning of Chamfer Welding Neck	Length Through Hub			Thread Length Threaded Flange, *Min*	Bore			Corner Radius of Bore of Lapped Flange and Pipe	Counter Bore Threaded Flange, *Min*	Drilling				Length of Stud Bolts, *L*		
						Threaded Slip-on	Lapped	Welding Neck		Slip-on, *Min*	Lapped, *Min*	Welding Neck			Diameter of Bolt Circle	Diameter of Bolt Holes	Numb& of Bolts	Nominal Dia of Bolts	7mm Raised Face	Mal & Female also Tongue & Groove	Ring Joint
DN	NPS	0	C	X	*A*	*Y*	*Y*	*Y*	*T*	*B*	*B*	*B*	*r*	*Q*							
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
15	$^1/_2$	Use PN 250 dimensions in these sizes																			
20	$^3/_4$																				
25	1																				
32	$1^1/_4$																				
40	$1^1/_2$																				
50	2																				
65	$2^1/_2$																				
80	3	240	38.3	127	89	54	54	102	42	90.5	91.5	To be specified by the purchaser	10	92	190.5	26	8	M24	145	140	150
100	4	295	44.5	159	114.5	70	70	114	48	116	117		11	118	235.0	32	8	M30	170	165	175
125	5	350	51.0	190	141	79	79	127	54	143.5	144.5		11	145	279.5	35	8	M33	190	185	195
150	6	380	56.0	235	168.5	86	86	140	57	170.5	171.5		13	171	317.5	32	12	M30	195	185	195
200	8	470	63.5	298	219	102	112	162	64	221.5	222		13	222	393.5	39	12	M36	220	215	225
250	10	545	70.0	368	273	108	127	184	71	276	277.5		13	275	470.0	39	16	M36	235	230	235
300	12	610	79.5	419	324	117	143	200	76	327	328		13	329	533.5	39	20	M36	255	250	255
350	14	640	86.0	451	355.5	130	156	213	83	359	360		13	360	559.0	42	20	M39	275	265	280
400	16	705	89.0	508	406.5	133	165	216	86	410.5	411		13	411	616.0	45	20	M42	285	280	295
450	18	785	102.0	565	457	152	191	229	89	462	462.5		13	462	686.0	52	20	M48	325	320	340
500	20	855	108.0	622	508	159	210	248	92	513	514.5		13	513	749.5	54	20	M52	345	340	360
600	24	1040	140,0	749	609.5	203	287	292	102	616	616		13	614	901.5	68	20	M68	435	430	455

Table 6 Dimensions of PN 250 Flanges

(*Clause* 4 and *Fig.* 1)

All dimensions in millimetres.

Nominal Size		Outside Dia of Flange	Thickness of Flange, *Min*	Dia of Hub	Hub Dia Beginning of Chamfer Welding Neck	Length Through Hub			Thread Length Threaded Flange, *Min*	Bore			Corner Radius of Bore of Lapped Flange and Pipe	Counter Bore Threaded Flange, *Min*	Depth of Socket	Drilling				Leogth of Stud Bolts, *L*		
						Threaded Slip-on Socket Welding	Lapped	Welding Neck		Slip-on Socket Welding, *Min*	Lapped, *Min.*	Welding Neck Socket Welding				Dia of Bolt Circle	Dia of Bolt Holes	Number of Bolts	Nominal Dia of Bolts	7 mm Raised Face	Male & Female also Tongue & Groove	Ring Joint
DN	NPS	*O*	*C*	X	A	Y	Y	Y	*T*	*B*	*B*	*B*	*r*	*Q*	*D*							
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
15	1/2	120	22.5	38	21.5	32	32	60	22	22.0	23		3	23.5	10	82.5	22	4	M20	105	100	105
20	3/4	130	25.5	44	26.5	35	35	70	25	28.0	28		3	29.0	11	89.0	22	4	M20	11.5	105	115
25	1	150	29.0	52	33.5	41	41	73	29	34.5	35		3	36.0	13	101.5	26	4	M24	125	120	125
32	1 1/4	160	29.0	64	42	41	41	73	30	43.5	43.5		5	44.5	14	111.0	26	4	M24	125	120	12.5
40	1 1/2	180	32.0	70	48	44	44	83	32	49.5	SO		6	50.5	16	124.0	30	4	M27	140	135	140
50	2	215	38.5	105	60.5	57	57	102	38	62	62.5		8	63.5	17	165.0	26	8	M24	145	140	145
65	2 1/2	245	41.0	124	73.0	64	64	105	48	74.5	75.5		a	76.0	19	190.5	30	8	M27	160	150	160
80	3	270	48.0	133	89.0	73	73	118	51	—	91.5		10	92.0	—	203.0	33	a	M30	180	170	180
100	4	310	54.0	165	114.5	90	90	124	57	—	117		11	118.0	—	241.5	36	8	M33	195	190	200
125	5	375	73.5	197	141.5	105	105	155	60	—	144.5		11	145.0	—	292.0	42	8	M39	250	240	250
150	6	395	83.0	229	168.5	119	119	171	69	—	171.5		13	171.0	—	317.5	39	12	M36	260	255	265
200	8	465	92.0	292	219	143	143	213	76	—	222		13	2220	—	393.5	45	12	M42	290	285	300
250	10	58.5	108.0	368	273	159	178	254	84	—	277.5		13	276.0	—	482.5	52	12	M48	335	330	345
300	12	675	124.0	451	324	181	219	283	92	—	328		13	329.0	—	571.5	56	16	M52	375	370	390
350	14	750	133.5	495	355.5	—	241	298	—	—	360		13	360.0	—	635.0	60	16	M56	405	400	425
400	16	825	146.5	552	406.5	–			—	—	411		13	411.0	—	705.0	68	16	M64	445	440	470
450	18	915	162.0	597	457	–			—	—	462.5		13	462.0	—	774.5	76	16	72	495	485	515
500	20	985	178.0	641	508	–			—	—	514.5		13	513.0	—	832.0	80	16	76	540	525	56.5
600	24	1170	203.5	762	610	–			—	—	616		13	614.0	—	990.5	94	16	90	615	610	645

To be specified by the purchaser

'Table 7 Dimensions of PN 420 Flanges

(Clause 4 and *Fig.* 1)

All dimensions in millimetres.

Nominal Size		outside Dia of Flange	Thick-ness of Flange, *Min*	Dia of Hub	Hub Dia Begin-ning of Chamfer Welding Neck	Length Through Hub			Thread Length Threaded Flange, *Min*	Bore		Corner Radius of Bore of Lapped Flange and Pipe	Counter Bore hreaded Flange, *Min*	Drilling				Length of Stud Bolts, *L*		
						Thread-ed	Lapped	Welding Neck		Lapped *Min*	Weld-ing Neck			Dia of Bolt Circle	Number of Bolts	Nomi-nal Dia of Bolts	Dia of Bolt Holes	7 mm Raised Face	Male & Female also Tongue & Groove	Ring Joint
DN	NPS	*O*	C	*X*	A	*Y*	*Y*	Y	*T*	*B*	*B*	*r*	Q							
		(2)	(3)	(4)	.	(6)	(7)	(8)	(9)	(10)	(11)	(1 2)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
15	1/2	135	30.5	43	21.5	40	40	73	29	23	To be specified by the purchaser.	3	23.5	89.0	4	M20	22	125	115	125
20	3/4	140	32.0	51	26.5	43	43	79	32	28		3	29.0	95.0	4	M20	22	125	120	125
25	1	160	35.0	57	33.5	48	48	89	35	35		3	36.0	108.0	4	M24	26	140	130	140
32	1 1/4	185	38.5	73	42.0	52	52	95	38	43.5		5	44.5	130.0	4	M27	30	150	145	155
40	1 1/2	205	44.5	79	48.5	60	60	111	44	50.0		6	50.5	146.0	4	M30	33	170	165	175
50	2	235	51.0	95	60.5	70	70	127	51	62.5		8	63.5	171.5	a	M27	30	175	170	180
65	2 1/2	270	57.5	114	73.0	79	79	143	57	75.5		8	76.0	197.0	8	M30	33	195	190	205
80	3	305	67.0	133	89.0	92	92	168	63	91.5		10	92.0	228.5	8	M33	36	220	215	230
100	4	355	76.5	165	114.5	108	108	190	70	117.0		11	118.0	273.0	8	M39	42	255	245	265
125	5	420	92.5	203	141.5	130	130	229	76	144.5		11	145.0	324.0	8	M45	48	300	290	310
150	6	485	108.0	235	168.5	152	152	273	82	171.5		13	171.0	368.5	8	M52	56	345	335	355
200	8	550	127.0	305	219.0	178	178	318	95	222.0		13	222.0	438.0	12	M52	56	380	375	395
250	10	675	165.5	375	273.0	229	229	419	108	277.5		13	276.0	539.5	12	M64	68	485	480	510
300	12	760	184.5	441	324.0	254	254	464	121	328.0		13	329.0	619.0	12	72	76	540	530	560

NOTES FOR TABLES 1 TO 7

1 For tolerances, see 9 to 9.10.

2 For facings, *see* 6.8.

3 For flange bolt holes, see 7.4 and corresponding flange tables.

4 For spot facing, see 7.5.

5 These dimensions are for large end of hub, which may be straight or tapered. Taper shall not exceed 7° on threaded, slip-on threaded, slip-on, socket welding and lapped flanges.

6 For reducing threaded and slip-on flanges, *see* Table 8.

7 For threads in threaded flanges, see 7.8 to 7.8.4.

8 Blind flanges may be made with or without hubs at the manufacturer's option.

9 For welding end bevel, *see* 7.6.

10 For reducing welding neck flanges, *see* 7.7.

11 Dimensions in col 12 of Table 1 to 6 and col 11 of Table 7 correspond to inside diameters of standard wall pipe. Thickness of standard wall is the same as SCH 40 (*see* Annex A) in sizes DN 250 and smaller. Tolerance in 9.5 shall apply.

12 The minimum thickness of these loose flanges, in various flange tables, in sizes DN 90 (NPS $3^1/_2$) and smaller is slightly greater than the thickness of flanges on fittings, which are reinforced by being cast integral with the body of the fitting.

13 When these flanges are required with flat face, either the full thickness or thickness with raised face removed may be furnished. Users are reminded that removing the raised face will make the length through the hub non-standard.

5.5 Size

The nominal diameter shall be given, but may be omitted from reducing flanges and reducing flanged fittings.

5.6 **Ring Joint Flange**

The edge (periphery) of each ring joint flange shall be marked with the letter "R" and the coresponding ring-groove number.

6 FITTING

6.1 **Wall** Thickness

For inspection purposes the minimum wall thickness t_m of flanged fittings atthe time of manufacture shall be as shown in corresponding flanged fitting rating Tables 9 to 15 read with Fig. 3 for flanged fittings without base and Tables 16 to 21 read with Fig. 4 for base type fittings. Additional metal thickness needed to withstand assembly stresses, shapes other than circular and stress concentrations must be determined by the manufacturer, since these factors vary widely. In particular, 45° laterals, true Y's and crosses may require additional reinforcement to compensate for inherent weaknesses in these shapes.

6.2 **Local** Deformities

Local areas having less than minimum wall thickness will be acceptable provided that all of the following are true:

a) The area of subminimum thickness may be enclosed by circle whose diameter is no greater than $0.35\sqrt{dt_m}$ where t_m is the minimum wall thickness as given in respective table.

b) Measured thickness is not less than $0.75t_m$.

c) Enclosure circles are separated from each other by an edge distance of more than $1.75\sqrt{dt_m}$.

6.3 Face to Face/End Dimensions

A principle of design in this standard is to maintain a fixed position for the flange edge with reference to the body of the fitting. The addition of any facing is beyond the outside edge of the flange except for the 1.6 mm raised face in Class PN 20 and PN 50.

6.4 **Reducing Fittings**

Centre-to-contact surface or centre-to-flange edge dimensions for all openings shall be the same as those of straight size fittings of the largest opening. The contact surface-to-contact surface or flanged edge-to-flange edge dimensions for all combinations of reducers and eccentric reducers shall be as listed for the larger opening.

6.5 **Side Outlet Fittings**

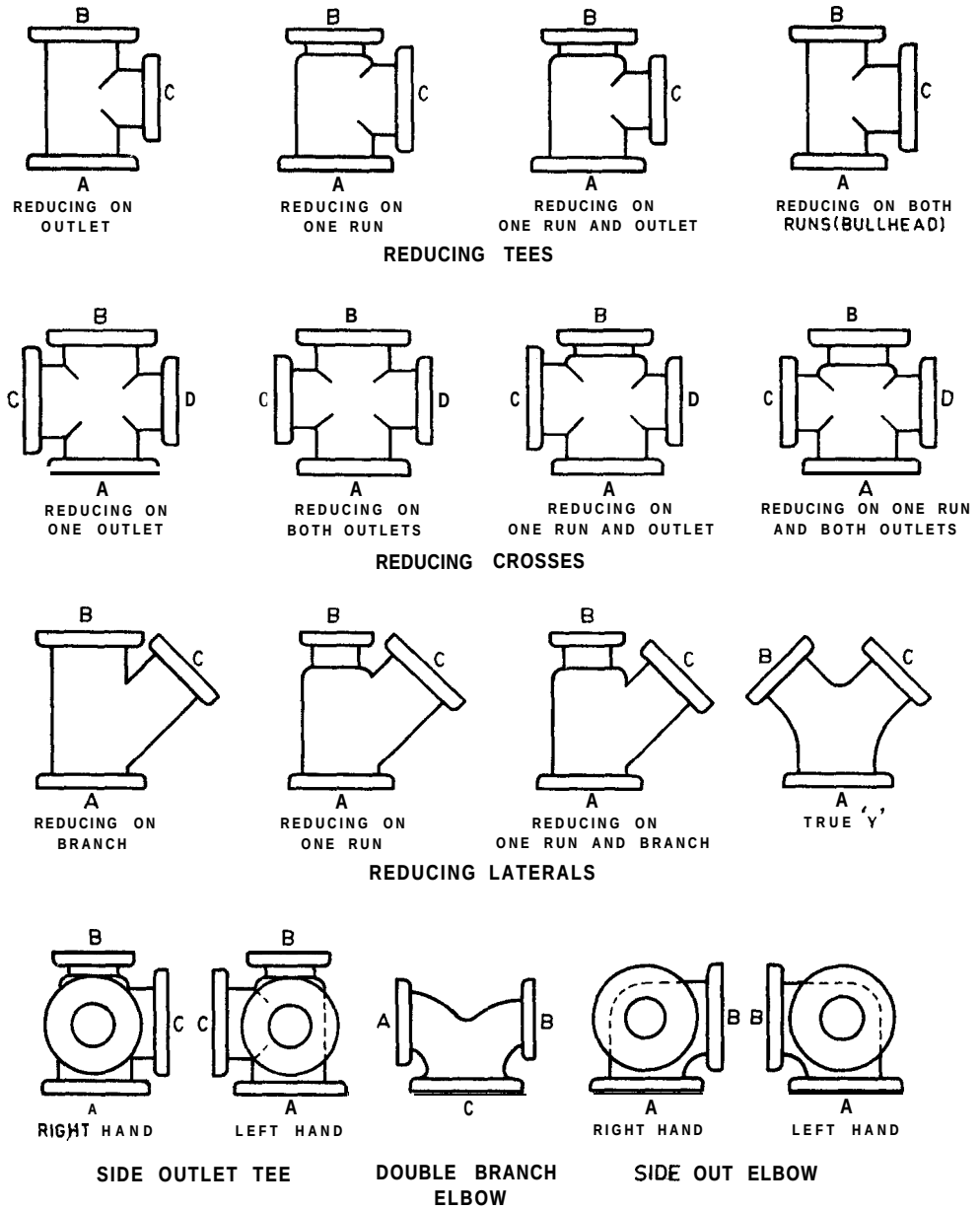
Side outlet elbows, side outlet tees and side outlet crosses shall have all opening on intersecting centre lines, and the ceutre-to-contact surface dimensions of the side outlet shall be the same as for the largest opening. Long radius elbows with side outlet shall have the side outlet on the radial centre line of the elbow, and the centre-to-contact surface dimension of the side outlet shall be the same as for the regular 90° elbow of the largest opening.

6.6 **Special Degree Elbows**

Special degree elbows ranging from 1° to 45° inclusive shall have the same centre-to-contact surface dimensions as 45° elbows and those over 45° and up to 90° inclusive shall have the same centre-to-contact surface dimensions as 90° elbows. The angle designation of an elbow is its deflection from straight line flow and is also the angle between the flange faces.

6.7 **Auxiliary Connections**

No auxiliary connections, or openings will be provided except as specified by the purchaser. If assembly is required, the purchaser shall also specify the applicable code or regulation. Welded auxiliary connections shall be made by a qualified welder using a qualified weld procedure in accordance with IS 2825 : 1969.



NOTE – The largest opening establishes the basicsize of a reducing fitting The largest opening is named first, except that for bull head tees which are reducing on both runs and for double branch elbows where both branches are reducing, the outlet is the largest opening and named last in both cases.

In designating the openings of reducing fittings they should be read in the order indicated by the sequence of the letters *A, B, C* and *D.* In designating the outlets of side outlet reducing fittings the side outlet is named last and in the case of cross, which is not shown, the side outlet is designated by the letter *E*.

Sketches are illustrative only and do not imply required design.

FIG. 2 METHODS OF DESIGNATING OUTLETS OF REDUCING FITTINGS

Table 8 Reducing Threaded and Slip-on Pipe Flanges for PN 20 to PN 420

(Clause 4.2)

All dimensions in millimetres.

Nominal Pipe Size[3] DN	Smallest Size [1] of Reducing Outlet Requiring Hub Flanges	Nominal Pipe Size[3]	Smallest Size [1] of Reducing Outlet Requiring Hub Flanges	Nominal Pipe Size[3]	Smallest Size') of Reducing Outlet Requiring Hub Flanges
(1)	(2)	(1)	(2)	(1)	(2)
25	1s	90	40	300	90
32	15	100	40	350	90
40	15	125	40	400	100
50	25	150	65	450	100
65	32	200	80	500	100
80	32	250	90	550	100
				600	100

NOTES

1 The hub dimensions shall be at least as large as those of the standard flanges of the size to which the reduction is being made, except flanges reducing to a size smaller than those of column 2 may be made from blind flanges. See Example 2.

2 PN 80 flanges do not have a counterbore. DN 50 and higher pressure flanges will have depth of counterbore (g) of (6.4mm) for and smaller tapping and DN 50 (9.6 mm) for DN 65 and larger. The diameter(Q) of counterbore is the same as that given in the tables of threaded flanges for the corresponding tapping.

3 For method of designating reducing threaded flanges, *see* 4.2 and examples below.

Example 1

The size designation is DN 150 × 65 PN 50 reducing threaded flange.

This flange has the following dimensions:

318 mm diameter of regular DN 150 PN 50 threaded flange.

37 mm thickness of regular DN 150 PN 50 threaded flange.

178 mm diameter of hub for regular DN 150 PN 50 threaded flange.

16 mm height of hub for regular DN 150 PN 50 threaded flange.

Other dimensions the same as for regular DN 150 PN 50 threaded flange, see Table 4.

Example 2

The size designation is DN 150 × 50 PN 50 reducing threaded flange.

Use regular DN 150 PN 50 blind flange tapped with DN 50 parallel threads.

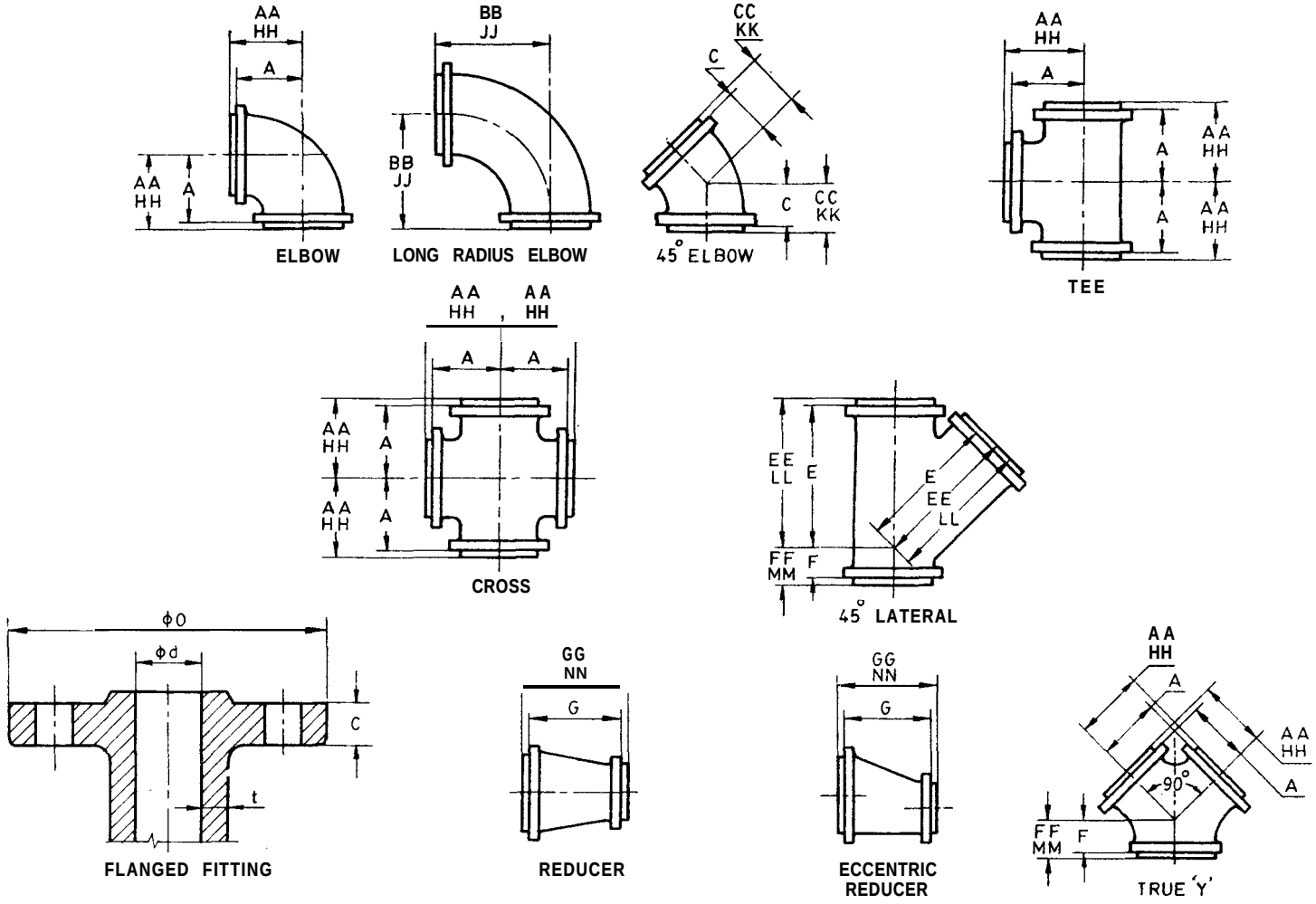


FIG. 3. LEGEND KEYS FOR DIMENSIONAL TABLES 9 TO 15

Table 9 Dimensions of PN 20 Flanged Fittings

(*Clause* 6.1 and *Fig. 3*)

All dimensions in millimetres.

Nominal Size		Outside Diameter of Flange	Thickness of Flange, *Min*	Wall Thickness of Fitting, *Min*	1.6 mm Raised Face							Ring Joint					
					Inside Diameter of Fitting	Centre-to-Contact Surface of Raised Face Elbow Tee Cross and True 'Y'	Centre-to-Contact Surface of Raised Face Long Radius E11	Centre-to-Contact Surface of Raised Face 45° E11	Long Centre-to-Contact Surface of Raised Face Lateral	Short Centre-to-% : : of Raised Face Lateral and True 'Y'	Contact Surface-& k of Raised Face Reducer	Centre-to-End Elbow Tee Cross and True 'Y'	Centre-to-End Long Radius E11	Centre-to-End 45° E11	Long Centre-to-End Lateral	Short Centre-to-End Lateral and True 'Y'	End-to-End Reducer
DN	NPS	0	c	t_m	*d*	*AA*	BB	c c	*EE*	*FF*	*GG*	*HH*	*JJ*	*KK*	*LL*	*MM*	NN
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
25	1	110	11.5	4.0	25	89	127	44	146	44	114	95	133	51	152	51	
32	$1^1/_4$	120	13.0	4.8	32	95	140	51	159	44	114	102	146	57	165	51	
40	$1^1/_2$	130	14.5	4.8	38	102	152	57	178	51	114	108	159	64	184	57	
50	2	150	16.0	5 . 6	51	114	165	64	203	64	127	121	171	70	210	70	
65	$2^1/_2$	180	17.5	5.6	64	127	178	76	241	64	140	133	184	83	248	70	
80	3	190	19.5	5.6	76	140	197	76	254	76	152	146	203	83	260	83	
90	$3^1/_2$	215	21.0	6.3	89	152	216	89	292	76	165	159	222	95	298	83	
100	4	230	24.0	6.3	102	165	229	102	305	76	178	171	235	108	311	83	
125	5	255	24.0	7.1	127	190	260	114	343	89	203	197	267	121	350	95	
150	6	280	25.5	7.1	152	203	292	127	368	89	229	210	298	133	375	95	
200	8	345	29.0	7.9	203	229	356	140	444	114	279	235	362	146	451	121	
250	10	405	30.5	8.6	254	279	419	165	521	127	305	286	425	171	527	133	
300	12	485	32.0	9.5	305	305	483	190	622	140	356	311	489	197	629	146	
350	14	535	35.0	10.3	337	356	546	190	686	152	406	362	552	197	692	159	
400	16	600	37.0	11.1	387	381	610	203	762	165	457	387	616	210	768	171	
450	18	635	40.0	11.9	438	419	673	216	813	178	483	425	679	222	819	184	
500	20	700	43.0	12.7	489	457	737	241	889	203	508	464	743	248	895	210	
600	24	815	48.0	14.3	590	559	864	279	1029	229	610	565	870	286	1035	235	

See Notes 6 and 11

Table 10 Dimensions of PN 50 Flanged Fittings

(Clause 6.1 and *Fig.* 3)

All dimensions in millimetres.

Nominal Size		Outside Dia of Flange	Thickness of Flange, *Min*	Wall Thickness of Fitting, *Min*	1.6 mm Raised Face							Ring Joint					
					Inside Diameter of Fitting	Centre-to-Contact Surface of Raised Face Elbow Tee Cross and True 'Y'	Centre-to-Contact Surface of Raised Face Long Radius E11	Centre-to-Contact Surface of Raised Face 45° E11	Long Centre-to-Contact Surface of Raised Face Lateral	Short Centre-to-Contact Surface of Raised Face Lateral and True 'Y'	Contact Surface-to-Contact Surface of Raised Face Reducer	Centre-to-End Elbow Tee Cross and True 'Y'	Centre-to-End Long Radius E11	Centre-to-End 45° E11	Long Centre-to-End Lateral	Short Centre-to-End Lateral and True 'Y'	End-to-End Reducer
DN	NPS	O	C	t_m	*d*	AA	*BB*	c c	*EE*	*F F*	*GG*	*HH*	*JJ*	*K K*	LL	*M M*	*NN*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
25	1	125	17.5	4.7	25	102	127	57	165	51	114	108	133	64	171	57	See Notes 6 and 11
32	1 1/4	135	19.5	5.5	32	108	140	64	184	57	114	114	146	70	190	64	
40	1 1/2	155	21.0	5.5	38	114	152	70	216	64	114	121	159	76	222	70	
50	2	165	225	6.3	51	127	165	76	229	64	127	135	173	84	237	71	
65	2 1/2	190	25.5	6.3	64	140	178	89	267	64	140	148	186	97	275	71	
80	3	210	29.0	7.1	76	152	197	89	279	76	152	160	205	97	287	84	
90	3 1/2	230	30.5	7.1	89	165	216	102	318	76	165	173	224	110	325	84	
100	4	255	320	7.9	102	178	229	114	343	76	178	186	237	124	351	84	
125	5	280	35.0	9.5	127	253	260	127	381	89	203	211	268	135	389	97	
150	6	320	37.0	9.5	152	216	292	140	444	102	229	224	300	148	452	110	
200	8	380	41.5	11.1	203	254	356	152	521	127	279	262	364	160	529	135	
250	10	445	48.0	127	254	292	419	178	610	140	305	300	427	186	618	148	
300	12	520	51.0	14.3	308	330	483	203	698	152	356	338	491	211	706	160	
350	14	585	54.0	15.9	337	381	546	216	787	165	406	389	554	224	795	173	
400	16	650	57.5	17.5	387	419	610	241	876	190	457	427	618	249	884	198	
450	18	710	60.5	19.0	432	457	673	254	952	203	483	465	681	262	960	211	
500	20	775	63.5	20.6	483	4%	737	267	1029	216	508	505	746	276	1038	225	
600	24	915	70.0	23.8	585	572	864	305	1206	254	610	583	875	316	1218	265	

Table 11 Dimensions of PN 68 Flanged Fittings

(*Clause* 6.1.1 and *Fig.* 3)

All dimensions in millimetres.

Nominal Pipe Size		Outside Dia of Flange	Thickness of Flange, *Min*	Wall Thickness of Fitting *Min*	Inside Dia of Fitting	Flange Edge					7 mm Raised Face					Ring Joint				
						Centre-to-Flange Edge Elbow Tee Cross and True 'Y'	Centre-to Flange Edge 45° E 11	Long Centre-to-Flange Lateral	Short Centre-to-Flange and True 'Y'	Flange Edge-to-Flange Edge Reducer	Centre-to-Contact Surface of Raised Face Elbow Tee Cross and True 'Y'	Centre-to-Contact Surface of Raised Face 45° E11	Long Centre-to-Contact Surface of Raised Face Lateral	Short Centre-to-Contact Surace of Raised Face Lateral and True 'Y'	Contact Surface to Contact Surface of Raised Face Reducer	Centre-to-End Elbow Tee Cross and True 'Y'	Centre-to-End 45° E11	Long Centre-to-End Lateral	Short Centre to-End Lateral and True 'Y'	End-to-End Reducer
DN	NPS	*O*	*C*	t_m	*d*	*A*	c	*E*	*F*	*G*	*AA*	c c	*EE*	*FF*	*GG*	H H	*KK*	*LL*	*MM*	*NN*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
15	1/2	Use PN 100 dimensions in these sizes.																		See Notes 6 and 11
20	3/4																			
25	1																			
32	1 1/4																			
40	1 1/2																			
50	2																			
65	2 1/2																			
80	3																			
90	3 1/2																			
100	4	254	35.0	9.5	102	196	133	399	107	196	203	140	406	114	210	20.5	141	408	118	
125	5	279	38.5	11.1	127	221	145	418	120	221	228	152	425	127	235	230	154	427	129	
150	6	318	41.5	11.1	152	241	152	469	126	240	248	159	476	133	254	249	160	477	135	
200	8	381	48.0	14.2	203	291	164	578	141	291	298	171	585	148	305	300	173	507	148	
250	10	445	54.0	17.4	254	329	192	647	152	331	336	197	654	159	345	338	198	656	160	
300	12	520	57.5	19.0	305	374	215	749	158	373	381	222	756	165	387	382	224	757	167	
350	14	585	60.5	20.6	333	406	228	825	171	405	413	235	832	178	419	414	236	833	179	
400	16	650	63.5	22.2	381	444	253	888	196	456	451	260	895	203	470	452	262	922	205	
450	18	710	67.5	23.8	432	481	266	990	209	481	488	273	997	216	495	490	275	990	217	
500	20	775	70.0	26.9	479	520	279	1079	222	519	527	286	1086	229	533	530	289	1089	232	
600	24	915	76.5	30.1	575	609	316	1269	282	608	616	323	1276	289	622	621	329	1281	271	

Table 12 Dimensions of PN 100 Flanged Fittings

(Clause 6.1 and Fig. 3)

All dimensions in millimetres

Nominal Size		Outside Dia of Flange	Thickness of Flange Min	Wall Thickness of Fitting Min	Inside Dia of Fitting	Flange Edge					7 mm Raised Face					Ring Joint				
						Centre-to-Flange Edge Elbow Tee Cross and True 'Y'	Centre-to-Flange Edge 4 E 11	Long Centre-to-Flange Lateral	Short Centre-to-Flange Lateral and True Y	Flange Edge-to-Flange Edge Reducer	Centre-to-Contact Surface of Raised Face Elbow Tee Cross and True 'Y'	Centre-to-Contact Surface of Raised Face 45° E 11	Long Centre-to-Contact Surface of Raised Face Lateral	Short Centre-to-Contact Surface of Raised Face Lateral and True 'Y'	Contact Surface to Contact Surface of Raised Face Reducer	Centre-to-End Elbow Tee Cross and True 'Y'	Centre-to-End 45° E 11	Long Centre-to-End Lateral	Short Centre-to-End Lateral and True Y	End-to-End Reducer
DN	NPS	*O*	C	t_m	*d*	*A*	*C*	*E*	*F*	G	*AA*	c c	EE	*FF*	GG	*HH*	*KK*	LL	*MM*	*NN*
		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
15	1/2	95	14.5	4.0	13	76	44	139	37	113	83	51	146	44	127	82	50	145	44	
20	3/4	117	16.0	4.0	19	88	57	164	44	113	95	64	171	51	127	95	64	171	51	
25	1	124	17.5	4.8	25	101	57	177	50	113	108	64	184	57	127	108	64	184	57	
32	1 1/4	133	21.0	4.8	32	107	63	196	57	113	114	70	203	64	127	114	70	203	64	
40	1 1/2	156	22.5	5.6	38	114	69	222	63	113	121	76	229	70	127	121	76	229	70	
50	2	165	25.5	6.3	51	139	101	253	82	138	146	108	260	89	152	148	110	262	90	
65	2 1/2	191	29.0	7.1	64	150	107	285	82	157	165	114	292	89	171	167	116	294	90	
80	3	210	32.0	7.9	76	171	120	319	95	170	178	127	324	102	184	179	129	325	103	
90	3 1/2	230	35.0	8.7	89	183	133	349	107	183	190	140	356	114	197	192	141	357	116	
100	4	275	38.5	9.5	102	209	145	412	107	208	216	152	419	114	222	217	154	421	116	
125	5	330	44.5	11.1	127	247	171	488	145	246	254	178	495	152	260	256	179	497	154	
150	6	355	48.0	22.7	152	272	183	526	158	272	279	190	533	165	286	281	192	535	167	
200	8	420	56.0	15.8	200	323	209	615	171	323	330	216	622	178	337	332	217	624	179	
250	10	510	63.5	19.0	248	387	234	742	196	386	394	241	749	203	400	395	243	751	205	
300	12	560	67.0	23.0	298	412	247	793	209	411	419	254	800	216	425	421	256	802	217	
350	14	605	70.0	24.6	327	437	266	863	222	437	444	273	870	229	451	446	275	872	230	
400	16	685	76.5	27.8	375	488	291	971	247	488	495	298	978	254	502	497	300	979	255	
450	18	745	83.0	31.0	419	539	304	1060	260	548	546	311	1067	267	552	548	313	1068	268	
500	20	815	89.0	34.1	464	590	323	1149	272	589	597	330	1156	279	603	600	333	1159	283	
600	24	940	102.0	40.5	560	691	368	1339	323	691	698	375	1346	330	705	704	379	1351	335	

See Notes 6 and 11

Table 13 Dimensions of PN 150 Flanged Fittings

(Clause 6.1 and *Fig. 3)*

All dimensions in millimetres.

Nominal Pipe Size		Outside Dia of Flange	Thickness of Flange *Min*	Wall Thickness of Fitting, *Min*	Inside Dia of Fitting	Flange Edge					7 mm Raised Face					Ring Joint				
						Centre-to-Flange Edge Elbow Tee Cross and Tru 'Y'	Centre-to-Flange Edge 45° E11	Long Centre-to-Flange Lateral	Short Centre-to-Flange Lateral and True 'Y	Flange Edge-to-Flange Edge Reducer	Centre-to-Contact Surface of Raised Face Elbow Tee Cross and True 'Y'	Centre-to-Contact Surface of Raised Face 45° E11	Long Centre-to-Contact Surface R & d Lateral	Short Centre-to-Contact Surface of Raised Face Lateral and True 'Y'	Contact Surface-to-Contact Surface of Raised Face Reducer	Centre-to-End Elbow Tee Cross and True 'Y'	Centre-to-% E11	Long Centre-to-End Lateral	Short Centre-to-End Lateral and True 'Y'	End-to-End Reducer
DN	NPS	0	C	t_m	d	A '	C	E	F	G	AA	CC	EE	FF	GG	HH	KK	LL	MM	NN
	)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
15	1/2	120	22.5	4.1	13															
20	3/4	130	25.5	4.8	i7															
25	1	150	29.0	5.6'	22															
32	1 1/4	160	29.0	6.3	29															
40	1 1/2	180	32.0	7.1	35															
50	2	215	38.5	7.9	48															
65	2 1/2	245	41.5	8.8	57															
80	3	240	38.5	10.3	73	184	133	361	107	183	190	140	368	114	197	192	141	370	116	
100	4	295	44.5	12.7	98	222	158	437	133	221	229	165	444	140	235	230	167	446	141	
125	5	350	51.0	15.1	121	272	183	526	15	272	279	190	533	165	286	291	192	535	167	
150	6	380	56.0 ,	18.3	146	298	196	565	15	297	305	203	572	165	311	306	205	573	167	
200	8	470	63.5	22.2	191	361	222	691	18	361	368	229	698	190	375	370	230	700	192	
250	10	545	70.0	27.0	238	412	247	793	2	411	419	254	800	216	425	421	256	802	217	
300	12	610	79.5	31.7	283	476	272	871	222	437	483	279	876	229	451	484	381	878	230	
350	14	640	86.0	35.2	311	507	285	920	234	469	514	292	927	241	483	519	297	932	246	
400	16	705	89.0	39.7	356	558	311	1029	260	519	565	318	1035	267	533	570	322	1040	271	
450	18	785	102.0	44.4	400	603	330	1149	298	608	610	337	1156	305	622	616	343	1162	311	
500	20	855	108.0	48.4	445	652	361	1269	323	659	660	368	1276	330	673	667	375	1283	337	
600	24	1040	140.0	57.9	535	768	450	1517	387	761	775	457	1524	394	775	784	467	1534	403	

Use PN 2.50 dimensions in these sizes.

See Notes 6 and 11

Table 14 Dimensions of PN 250 Flanged Fitting

(Clause **6.1** and *Fig.* **3** *)*

All dimensions in **millimetres.**

Nominal Size		Outside Dia of Flange	Thickness of Flange, *Min*	Wall Thickness of Fitting, *Min*	Inside Diameter of Fitting	Flange Edge					7 mm Raised Face					Ring Joint				
						Centre-to-Flange Edge Elbow Tee Cross and True 'Y'	Centre-to-Flange Edge 45° E11	Long Centre-to-Flange Edge Lateral	Short Centre-to-Flange Lateral and True 'Y'	Flange Edge-to-Flange Edge Reducer	Centre-to-Contact Surface of Raised Face Elbow Tee Cross and True 'Y'	Centre-to-Contact Surface of Raised Face 45° E11	Long Centre-to-Contact Surface of Raised Face Lateral	Short Centre-to-Contact Surface of Raised Face Lateral and True 'Y'	Contact Surface-to-Contact Surface of Raised Face Reducer	Centre-to-End Elbow Tee Cross and True 'Y'	Centre-to-End 45° E11	Long Centre-to-End Lateral	Short Centre-to-End Lateral and True 'Y'	End-to-End Reducer
DN	NPS	*O*	*C*	t_m	*d*	*A*	*C*	*E*	*F*	*G*	*AA*	*CC*	*EE*	*FF*	*GG*	*HH*	*KK*	*LL*	*MM*	*NN*
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(11)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(1a)	(19)	(20)
15	1/2	120	22.5	4.7	13	101	69	—	—	—	108	76	—	—	—	108	76	—		
20	3/4	130	25.5	5.6	17	107	76	—		—	114	83	—	—	—	114	a3	—		
25	1	150	29.0	6.3	22	120	82	222	57	113	127	a9	229	64	127	127	89	229	63.5	
32	1 1/4	160	29.0	7.9	29	133	95	247	69	132	140	102	254	76	146	140	102	254	76.0	
40	1 1/2	180	32.0	9.5	35	145	101	272	82	145	152	108	279	89	159	152	108	279	a9	
50	2	215	38.5	11.7	48	177	114	330	95	170	184	121	337	102	184	186	122	338	103	
65	2 1/2	245	41.5	12.7	57	203	126	380	107	186	210	133	387	114	210	211	135	389	116	
80	3	270	48.0	15.9	76	228	139	431	120	221	237	146	438	127	235	237	148	440	129	
100	4	310	54.0	19.0	92	266	171	482	145	259	273	184	489	152	273	275	186	491	154	
125	5	375	73.5	23.2	111	300	215	584	183	336	337	222	591	190	350	338	224	592	192	
150	6	395	83.0	27.8	137	346	231	625	199	354	353	238	632	206	368	356	241	635	210	
200	8	485	92.5	35.7	178	409	269	752	225	418	416	276	759	232	432	421	281	764	237	
250	10	585	108.0	43.7	222	488	298	907	253	500	495	305	914	260	514	500	310	919	265	
300	12	675	124.0	50.8	264	558	330	1028	298	570	565	337	1035	305	584	573	344	1043	313	
350	14	750	133.5	55.6	289	622	355	1111	311	640	629	362	1118	318	654	638	371	1127	327	
400	16	825	146.5	63.5	330	685	406	1219	368	704	692	413	1226	375	718	704	424	1237	386	
450	18	915	162.0	71.4	371	761	444	1346	412	786	768	451	1353	419	800	780	462	1364	430	
500	20	985	178.0	79.4	416	825	469	1460	444	850	832	476	1467	451	864	843	487	1478	462	
600	24	1170	203.5	94.5	485	965	520	1701	514	996	972	527	1708	521	1010	986	541	1722	53.5	

See Notes 6 and 11

Table 15 Dimensions of PN 420 Flanged Fittings

(Clause 6.1 and *Fig. 3*)

All dimensions in millimetres.

Nominal Size DN	NPS	Outside Dia of Flange O	Thickness of Flange, *Min* C	Wall Thickness of Fitting, *Min* t_m	Inside Dia of Fitting d	Flange Edge: Centre-to-Flange Edge Elbow Tee Cross and True 'Y' A	Flange Edge: Centre-to-Flange Edge 45° E11 C	Flange Edge: Long Centre-to-Flange Lateral E	Flange Edge: Short Centre-to-[illegible] and True 'Y' F	Flange Edge: Flange Edge-to-Flange Edge Reducer G	7 mm Raised Face: Centre-to-contact surface of Raised Face Elbow Tee Cross and True 'Y' AA	7 mm Raised Face: Centre-to-Contact surface of Raised Face 45° E11 c c	7 mm Raised Face: Long Centre-to-Contact surface of Raised Face Lateral EE	7 mm Raised Face: Short Centre-to-Contact Surface of Raised Face Lateral and True 'Y' FF	7 mm Raised Face: Contact Surface-to-Contact Surface R & d Reducer GG	Ring Joint: Centre-to-End Elbow Tee Cross and True 'Y' HH	Ring Joint: Centre to-% E11 KK	Ring Joint: Long Centre-to-End Lateral LL	Ring Joint: Short Centre-to-End Lateral and True 'Y' MM	End-to-End Reducer NN
		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
15	1/2	135	30.0	6.3	11	125	—	—	—	—	132	—	—	—	—	132	—	—	—	
20	1/4	140	32.0	7.1	14	130	—	—	—	—	137	—	—	—	—	137	—	—	—	
2s	1	160	35.0	8.1	19	147	9s	—	—	—	154	102	—	—	—	154	102	—	—	
32	1 1/4	185	38.0	11.1	2s	168	101	—	—	—	17s	108	—	—	—	176	110	—	—	
40	1 1/2	205	44.5	127	29	185	114	—	—	—	192	121	—	—	—	194	122	—	—	
so	2	235	51.0	15.8	38	218	139	380	126	227	225	146	387	133	241	227	148	389	13s	
65	2 1/2	270	57.0	19.0	48	247	152	431	139	253	254	159	438	146	267	257	162	441	149	
80	3	305	60.5	22.2	57	282	177	49s	164	284	289	184	SO2	171	298	292	187	SOS	17s	
100	4	355	70.0	21.1	73	330	209	577	190	329	337	216	584	197	343	341	221	589	202	
125	S	420	92.0	34.1	92	390	247	685	228	386	397	254	692	235	400	403	260	698	241	*See* Notes 6 and 11
150	6	485	108.0	40.4	111	450	285	787	260	443	457	292	794	267	457	464	298	800	273	
200	8	550	127.0	52.3	146	SO4	3[illegible]	888	291	507	511	324	895	298	521	519	332	903	306	
250	10	675	165.0	65.8	184	628	399	1092	368	634	635	406	1099	37s	648	646	418	1110	386	
300	12	760	184.0	76.9	219	704	444	1244	406	723	711	451	1251	413	737	722	462	1262	424	

NOTES TO TABLES 9 TO 15

1 For tolerances, see 9 to 9.3.

2 For facings, *see* 6.8 and 6.9.

3 For flange bolt holes, see 7.4 and appropriate flange table.

4 For spot facing, *see* 7.5.

5 For centre-to-contact surface and centre-to-end dimensions of reducing fittings, see 6.3 to 6.6.

6 For contact surface-to-contact surface and end-to-end dimensions of reducers and eccentric reducers, see 6.4.

7 For intersecting centre lines, centre-to-contact surface and centre-to-end dimensions of side outlet fittings, see 6.5.

8 For centre-to-contact surface and centre-to-end dimensions of special degree elbows, see 6.6.

9 For reinforcement of certain fittings, see 6.

10 For drains, *see* 6.7

11 Dimensions *HH, JJ, KK, LL* and MM apply to straight sizes only. *See* 6.4 and 6.8.4. For centre-to-end dimensions of reducing fittings or end-to-end dimensions of reducers, use centre-to-contact surface or contact surface to contact surface dimensions of 2 mm raised face (flanged edge) for largest opening and add the proper height to provide for ring-joint groove applying to each flange. Sea Table 23 for ring-joint facing dimensions.

12 When these fittings are required with flat-faced flange, either the full thickness or thickness with raised face removed may be furnished. Users are reminded that removing the raised face will make the centre-to-face dimension non-standard.

6.7.1 *Pipe Thread Tapping*

Holes may be tapped in the wall of a fitting if the metal is thick enough to allow the effective thread length specified in Fig. 5. Where thread length is insufficient or the tapped hole needs reinforcement, a boss shall be added.

6.7.2 Sockets

Sockets (socket welding) may be provided in the wall of a fitting if the metal is thick enough to afford the depth of socket and retaining well specified in Fig. 6. Where the wall thickness is insufficient, or the size of the connection requires opening reinforcement, a boss shall be added.

6.7.3 *Butt- Weld*

Connections may be attached by butt-welding directly to the wall of the fitting as shown in Fig. 7. Where the size of an opening requires reinforcement, a boss shall be added.

6.7.4 *Bosses*

Where bosses are required, the diameters shall be not less than those shown in table under Fig. 8.

6.7.5 Size

Unless otherwise specified, auxiliary connections shall be of the pipe sizes given below:

Fitting Size	*Connection*
DN	DN
50 - 100	15
125 - 200	*20*
250 and above	*2.5*

6.7.6 *Designating Locations*

The means of designating the locations for auxiliary connections in fittings is shown in Fig. 9. Each possible location is designated by a letter so that the desired locations for the various types of fittings may be specified without using further sketches or description.

6.8 Facings (Except Lap Joints)

6.8.1 Table 22 gives dimensions for facings other than ring-joint. Table 23 gives dimensions for ring-joint facings. Fig. 10 shows application of facings. PN 20 and PN 50 fittings and companion flanges are regularly furnished with a 1.6 mm raised face which is included jn the minimum flange thickness 'C'. Higher class fittings and companion flanges are regularly furnished with 6.4 mm raised face which is additional to the minimum flange thickness 'C'.

6.8.1.1 For small male and female joints care should be taken in the use of dimensions in Table 22 to ensure that the inside diameter of fitting or pipe is small enough to permit sufficient bearing surface to prevent the crushing of the gasket. This applies particularly on lines where the joint is made on the end of the pipe. Inside diameter of fitting should match inside diameter of pipe as specified by the purchaser. Threaded companion flanges for small male and female joints are furnished with plain face. Large male and female faces and large tongue and groove are not applicable to PN 20 because potential dimensional differ.

6.8.2 No metal shall be cut from the minimum flange thickness specified herein except on class 150 and 300 flanges; then the raised face may be removed when bolting to cast iron flanges.

6.8.3 In the case of the 6.4 mm raised face, tongue or male face (other than 1.6 mm) raised face for PN 20 and PN 50, the minimum flange thickness 'C' shall be first provided and then the raised face, tongue or male face shall be added thereto.

6.8.4 With ring-joint, groove, or female face, the minimum flange thickness shall be first provided and then sufficient metal added thereto so that the bottom of the ring-joint groove, or the contact face of the groove or female face is in the same plane as the flange edge of a full thickness flange.

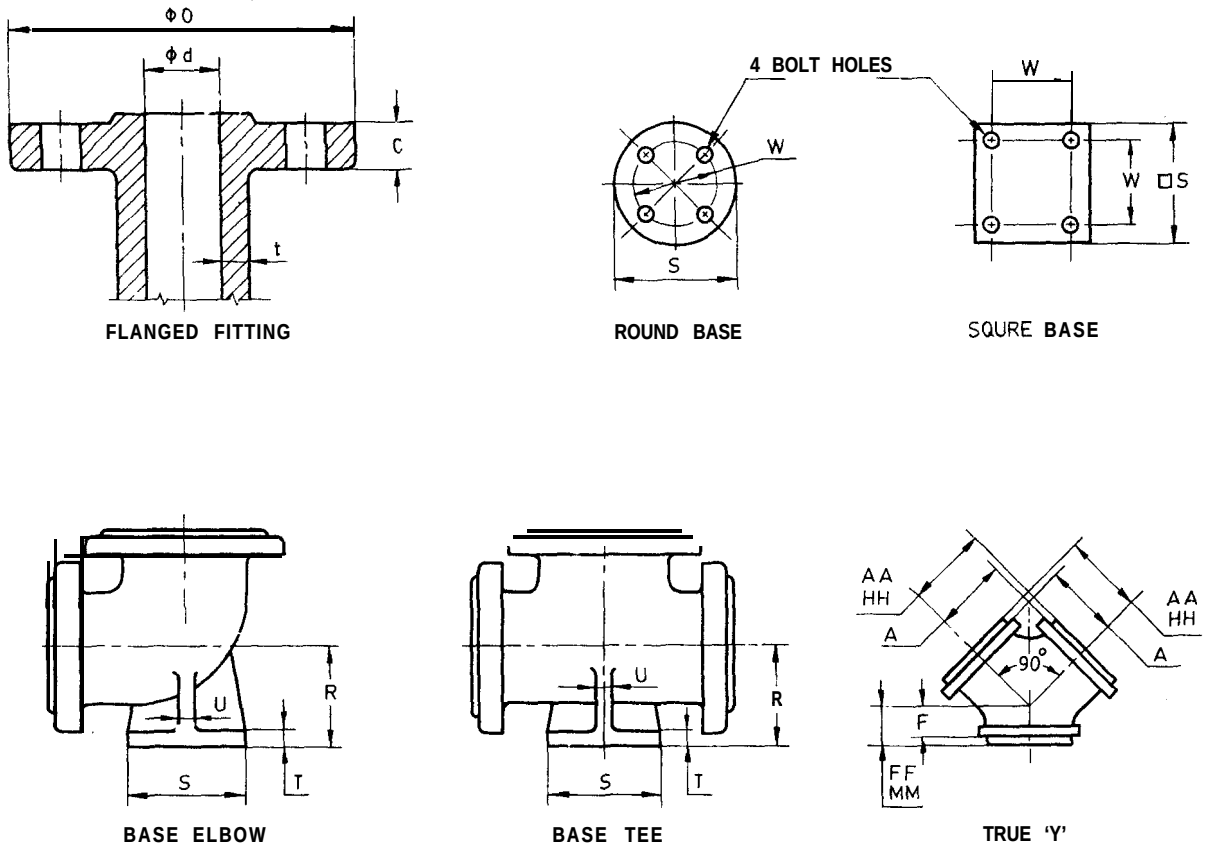


FIG. 4 LEGEND KEY FOR DIMENSIONAL TABLES 16 TO 21

6.9 Facing (Lapped Joints)

6.9.1 ***Raised Face***

Finished height of face shall be no less than nominal pipe wall thickness.

6.9.2 ***Large Male and Female***

Finished height of a male face shall be no less than wall thickness of pipe used or 6.4 mm whichever is greater. Thickness of lap remaining after machining the female face shall be no less than the nominal wall thickness of pipe used.

6.9.3 ***Tongue and Groove***

Thickness of lap remaining after machining tongue or groove face shall be no less than the nominal wall thickness of the pipe used.

6.9.4 ***Ring Joint***

Thickness of lap remaining after remaining the ring-groove shall be no less than the nominal wall thickness of pipe used.

6.9.5 The outside diameters of laps for ring joints are shown in Table 23, dimension ***K.*** The outside diameters of laps for large female, large tongue and groove and small tongue and groove are shown in Table 22. Small male and female facings are not used with lapped joints.

6.9.6 ***Blind Flanges***

Need not be faced in the centre if, when this centre part is raised, its diameter is at least 25 mm smaller than the inside diameter of fittings of the corresponding pressure class, as given in tables. When the centre part is depressed, its diameter shall not be greater than the inside diameter of the corresponding pressure class fittings, as given in the tables. Machining of the depressed centre is not required.

7 FINISH

The finish of contact faces of pipe flanges and connecting end flanges of fittings shall be judged by visual comparison and not by instruments having stylus tracers and electronic amplification. The finishes required are given in **7.1**, **7.2** and 7.3. Other finishes may be furnished by agreement between the user and the manufacturer.

7.1 **Raised Face and Large Male and Female**

Either a serrated-concentric or a serrated-spiral finish having from 0.6 to 1 mm pitch shall be used. The cutting tool employed shall have an approximate 3.2 to 12.5 μm roughness.

7.2 **Tongue and Groove and Small Male and Female**

The gasket contact surface shall not exceed 3.2μm roughness.

Table 16 Dimensions of PN 20 Flanged Fittings (Base Type)

(*Clause* 6.1 and *Fig. 4)*

All dimensions in millimetres.

Nominal Size DN	Centre-to-Base[1,2,5] *R*	Diameter of Hound Base or Width of Square Base *S*	Thickness of Base[1,3] *T*	Thickness of Ribs' *U*	Base Drilling[4]	
					Bolt Circle or Boll Spacing *W*	Diameter of Drilled Holes
(1)	(2)	(3)	(4)	(5)	(6)	(7)
25	—	—	—	—	—	—
32	—	—	—	—	—	—
40	—	—	—	—	—	—
so	105	117	13	13	89.0	16
65	114	117	13	13	89.0	16
80	124	127	14	14	98.5	16
90	133	127	14	14	98.5	16
100	140	152	16	16	120.0	20
125	159	178	17	17	139.5	20
150	178	178	17	17	139.5	20
200	213	229	24	24	190.5	20
250	24x	229	24	24	190.5	20
300	286	279	25	25	241.5	23
350	318	279	25	25	241.5	23
400	349	279	25	25	241.5	23
450	381	343	28	28	298.5	23
500	406	343	28	28	298.5	23
600	470	343	28	28	298.5	23

NOTES

1 The base dimensions apply to all straight and reducing sizes.

2 For reducing fittings the size and centre-to-face dimensions of base are determined by the size of the largest opening of the fitting. In the case of reducing base elbows, purchaser shall specify whether the base shall be opposite the larger or smaller opening.

3 Bases may be cast integral or attached as weldments at the manufacturer's option.

4 The bolt hole template is the same as for PN 20 flanges. Table I. of corresponding outside diameter. except that only four bolt boles are used. with pairs of holes straddling centre lines. The bases of these fittings are intended for support in compression and are not to be used as anchors or supports in tension or shear.

5 Bases shall be plain faced unless otherwise specified. and the centre-to-base dimension '*R*' shall be tbe finished dimension.

6 When these fittings are required with flat-faced flange. eitherthe full thickness or thickness with raised face removed may be furnished. Users are reminded that removing tbe raised face will make the centre-to-face dimension non-standard.

Table 17 Dimensions of PN 50 Flanged Fittings (Base Type)

(*Clause* 6.1 and *Fig. 4)*

All dimensions in millimetres.

Nominal Size DN	Centre-to-Base[1,2,5] *R*	Diameter of Round Base or Width of square Base[1] S	Thickness of Base[1,3] *T*	Thickness of Ribs[1] *U*	Base Drilling[4]	
					Bolt Circle or Bolt Spacing *W*	Diameter of Drilled Holes
(1)	(2)	(3)	(4)	(5)	(6)	(7)
25	—	—	—	—	—	—
32	—	—	—	—	—	—
40	—	—	—	—	—	—
50	114	133	19	13	98.5	20
65	120	133	19	13	98.5	20
80	133	156	21	16	114.5	23
90	143	156	21	16	114.5	23
100	1.52	165	22	16	127.0	20
125	171	191	25	19	149.0	23
150	190	191	25	19	149.0	23
200	229	254	32	22	200.0	23
250	267	254	32	22	200.0	23
300	305	318	36	25	269.5	23
350	343	318	36	25	270.0	23
400	375	318	36	28	270.0	23
450	413	381	42	32	330.0	26
500	454	381	42	32	330.0	26
600	527	445	48	32	387.5	29

NOTES

1 The base dimensions apply to all straight and reducing sizes.

2 For reducing fittings the size and centre-to-face dimensions of base are determined by the size of the largest opening of the fitting. In the case of reducing base elbows, purchaser shall specify whether the base shall he opposite to the larger or smaller opening.

3 Bases may be cast integral or attached as weldments at the manufacturer's option.

4 The bolt bole template is the same as for PN 50 flanges, Table 2 of corresponding outside diameter, except that only four bolt holes are used, with pairs of boles straddling centre lines. The bases of these fittings are intended for support in compression and are not to be used as anchors or supports in tensions or shear.

5 Bases shall be plain faced unless otherwise specified, and the centre-to-base dimension *'R'* shall be the finished dimension.

6 When these fittings are required with flat-faced flanges either the full thickness or thickness with raised face removed may be furnished. Users are reminded that removing the raised face will make the centre-to-face dimension non-standard.

Table 18 Dimensions of PN 68 Flanged Fittings (Base Type)

(Clause 6.1 and *Fig. 4)*

All dimensions in millimetres.

Nominal Size DN	Centre-to-Base[1,2,5] *R*	Diameter of Round Base or Width of Square Base[1] *S*	Thickness of Base[1,3] *T*	Thickness of Ribs[1] *U*	Base Drilling[4]	
					Bolt Circle or Bolt Spacing *W*	Diameter of Drilled Holes
(1)	(2)	(3)	(4)	(5)	(6)	(7)
15	Use PN 100 dimensions in these sizes					
20						
25						
32						
40						
50						
65						
80						
90						
100	152	165	22	16	127	20
125	171	190	25	19	149	23
150	191	190	25	19	149	23
200	229	254	32	22	200	23
250	267	254	32	22	200	23
300	305	318	37	25	270	23
350	343	318	37	25	270	23
400	375	318	37	29	270	23
450	413	381	41	29	330	26
500	454	381	41	32	330	28
600	527	444	48	32	387	29

NOTES

1 The base dimensions apply to all straight and reducing sizes.

2 For reducing fittings the size and centre-to-face dimensions of base are determined by the size of the largest opening of the fitting. In the case of reducing base elbows, purchaser shall specify whether the base shall be opposite the larger or smaller opening.

3 Bases may be cast integral or attached as weldments at the manufacturer's option

4 The bolt hole template is the same as for PN 68 flanges, Table 3 or corresponding outside diameter, except that only four bolt holes are used, with pairs of holes straddling centre lines. The bases of these fittings are intended for support in compression and are not to be used as anchors or support in tension or shear.

5 Bases shall be plain faced unless otherwise specified, and the centre-to-base dimension '*R*' shall be the finished dimension.

Table 19 Dimensions of PN 100 Flanged Fittings (Base Type)
(*Clause* 6.1 and *Fig.* 4)

All dimensions in millimetres.

Nominal Size DN	Centre-to-Base[1,2,5] *R*	Diameter of Round Base or Width of Square Base[1] S	Thickness of Base[1,3] *T*	Thickness of Ribs' *U*	Base Drilling[4]	
					Bolt Circle or Bolt Spacing *W*	Diameter of Drilled Holes
(1)	(2)	(3)	(4)	(5)	(6)	(7)
15	—	—	—	—	—	—
20	—	—	—	—	—	—
25	—	—	—	—	—	—
32	—	—	—	—	—	—
40	—	—	—	—	—	—
50	121	155	21	16	114	23
65	133	155	21	16	114	23
80	146	165	22	19	127	20
90	165	165	22	19	127	20
100	178	190	25	19	149	23
125	210	254	32	19	200	23
150	229	254	32	19	200	23
200	279	318	37	25	270	23
250	318	318	37	25	270	23
300	337	381	41	28	330	26
350	375	381	41	28	330	26
400	406	381	41	32	330	26
450	—	—	—	—	—	—
500	—	—	—	—	—	—
600	—	—	—	—	—	—

NOTES

1 The base dimensions apply to all straight and reducing size.

2 For reducing fittings the size and centre-to-face dimensions of base are determined hy the size of the largest opening of the fitting. In the case of reducing base elbows, orders shall specify whether the base shall be opposite the larger or smaller opening.

3 Bases may be cast integral or attached as weldments at the option of the manufacturer.

4 The bolt hole template for round base is the same as for PN 100 flanges, Table 4 of corresponding outside diameter, except using only for holes in all cases so placed as to straddle centre lines. The bases of these fittings arc intended to support in compression and are not to be used for anchors or supports in tension or shear.

5 Bases shall be plain faced unless otherwise specified, and the centre-to-base dimensions *'R'* shall be the finished dimensions.

Table 20 Dimensions of PN 150 Flanged Fittings (Base Type)
(*Clause* 6.1 and *Fig. 4)*

All dimensions in millimetres.

Nominal Size DN	Centre-to-Base[1,2,5] *R*	Diameter of Round Base or Width of Square Base' S	Thickness of Base[1,3] *T*	Thickness of Ribs' *U*	Base Drilling[4]	
					Bolt Circle or Bolt Spacing *W*	Diameter of Drilled Holes
(1)	(2)	(3)	(4)	(5)	(6)	(7)
15	Use PN 250 dimensions in these sizes					
20						
25						
32						
40						
50						
65						
80	140	165	22	19	127	20
100	178	190	25	19	149	23
125	210	254	32	19	200	23
150	229	254	32	19	200	23
200	279	318	37	25	270	23
250	318	318	37	25	270	23
300	337	318	41	29	330	26
350	375	381	41	29	330	26
400	406	381	41	32	330	26
450	—	—	—	—	—	—
500	—	—	—	—	—	—
600	—	—	—	—	—	—

NOTES

1 The base dimensions apply to all straight and reducing sizes.

2 For reducing fittings the size and centre-to-face dimension of base are determined by the size of the largest opening of the fitting. In the case of reducing base elbows, orders shall specify whether rhe base shall be opposite the larger or smaller opening.

3 Bases may be cast integral or attached as weldments at the manufacturer's option.

4 The bolt hole template for round base is the same as for PN 150 flanges, Table 5 of corresponding outside diameter. except that only four holes in all cases so placed as to straddlecentre lines. The bases of these fittings are intended to support in compression and are not to be used for anchors or support in tension or shear.

5 Bases shall be plain faced unless otherwise specified, and the centre-to-base dimension 'R' shall be the finished dimension.

Table 21 Dimensions of PN 250 Flanged Fittings (Base Type)
(*Clause* 6.1 and *Fin.* 4)

All dimensions in millimetres.

Nominal Size DN	Centre-to-Base[1,2,5] *R*	Diameter of Round Base or Width of Square Base' S	Thickness of Base[1,3] *T*	Thickness of Ribs' *U*	Base Drilling[4]	
					Bolt Circle or Bolt Spacing *W*	Diameter of Drilled Holes
(1)	(2)	(3)	(4)	(5)	(6)	(7)
15	—	—	—	—	—	—
20	—	—	—	—	—	—
25	—	—	—	—	—	—
32	—	—	—	—	—	—
40	—	—	—	—	—	—
50	140	165	22	19	127	20
65	152	165	22	19	127	20
80	165	190	25	19	149	23
100	197	254	32	19	200	23
125	229	254	32	19	200	23
150	248	318	37	25	270	23
200	292	318	37	25	270	23
250	349	381	41	29	330	26
300	394	381	41	29	330	26
350	433	444	48	32	387	29
400	476	444	48	32	387	29
450	—	—	—	—	—	—
500	—	—	—	—	—	—
600	—	—	—	—	—	—

NOTES

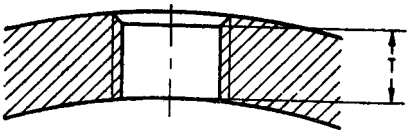
1 The base dimensions apply to all straight and reducing sizes.

2 For reducing fittings the size and centre-to-face dimensions of base determined by the size of the largest opening of the fitting. In the case of reducing base elbows, orders shall specify whether the base shall be opposite the larger or smaller opening.

3 Bases may be cast integral or attached as weldments at the manufacturer's option.

4 The bolt hole template for round base is the same as for PN 250 flanges. Table 6 of corresponding outside diameter. except using only four holes in all cases so placed as to straddle centre lines. The bases of these fittings are intended to support in compression and are not to be used as anchors or supports in tension or shear.

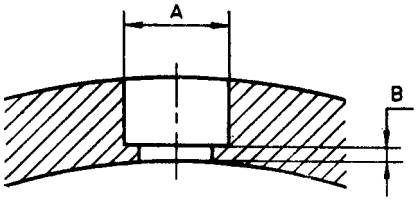
5 Bases shall be plain faced unless otherwise specified, and the centre-to-base dimension *'R'* shall be the finished dimensions.



Connection Size, DN	10	15	20	25	32	40	50
Thread Length T, mm	10.5	13.5	14.0	17.5	18.1	18.3	19.4

NOTE – In no case shall the effective length of thread, *T,* be less than that shown in table above. These lengths are equal to the effective thread length of External Pipe Threads.

FIG. 5 THREAD LENGTH FOR CONNECTION TAPPING



Connection Size, DN	10	15	20	25	32	40	50
Minimum Dia of Socket, A, mm	17.5	21.8	26.9	33.8	42.7	48.8	61.2
Minimum Depth, B, mm	4.8	4.8	6.4	6.4	6.4	6.4	7.9

FIG. 6 SOCKET WELDING FOR CONNECTIONS

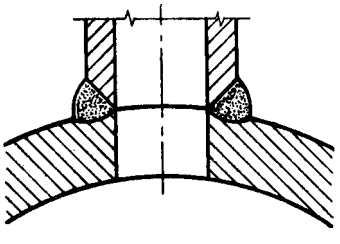
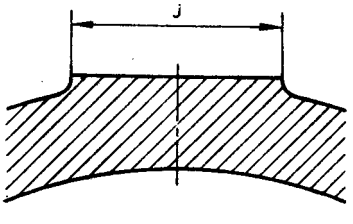
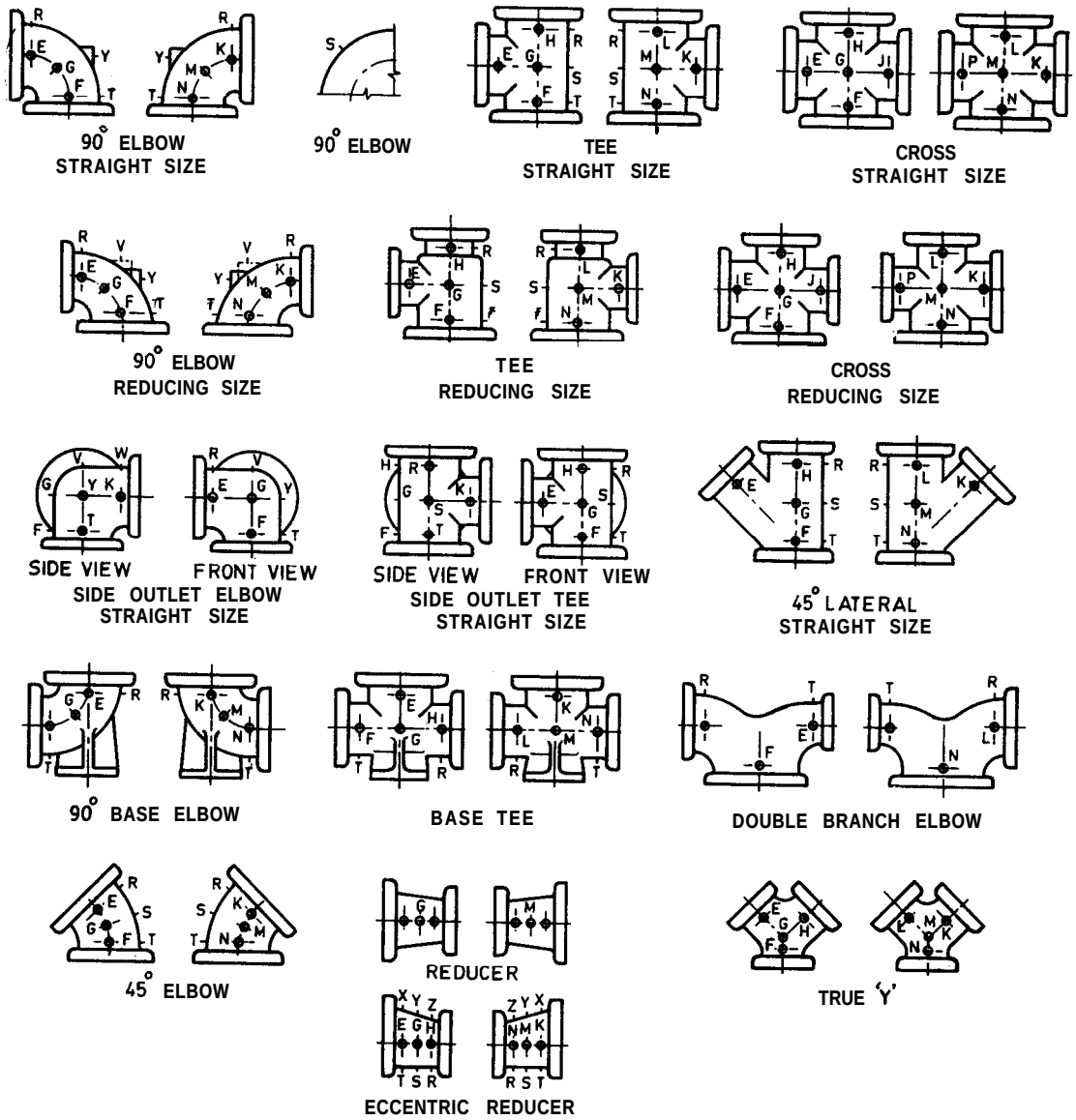


FIG. 7 BURT WELDING FOR CONNECTIONS



Connection Size, DN	10	15	20	25	32	40	50
Minimum Boss Dia, J, mm	31.8	38.1	445	53.8	635	69.8	85.8

FIG. 8 BOSSES FOR CONNECTIONS



NOTE — The above sketches show two views of the same fitting and represent fittings with symmetrical shapes, with the exception of the sideoutlet elbow and the sideoutlet tee (straight sizes). Sketches are illustrative only and do not imply required design.

FIG. 9 METHOD OF DESIGNATING LOCATION OF AUXILIARY CONNECTIONS

7.3 Ring Joint

The side wall surface of gasket groove shall not exceed 1.60 μm roughness.

7.4 **Flange Bolt Holes**

Bolt holes are in multiples of four. Bolt holes shall be equally spaced and pairs of bolt holes shall straddle fitting centre lines.

7.5 **Spot Facing**

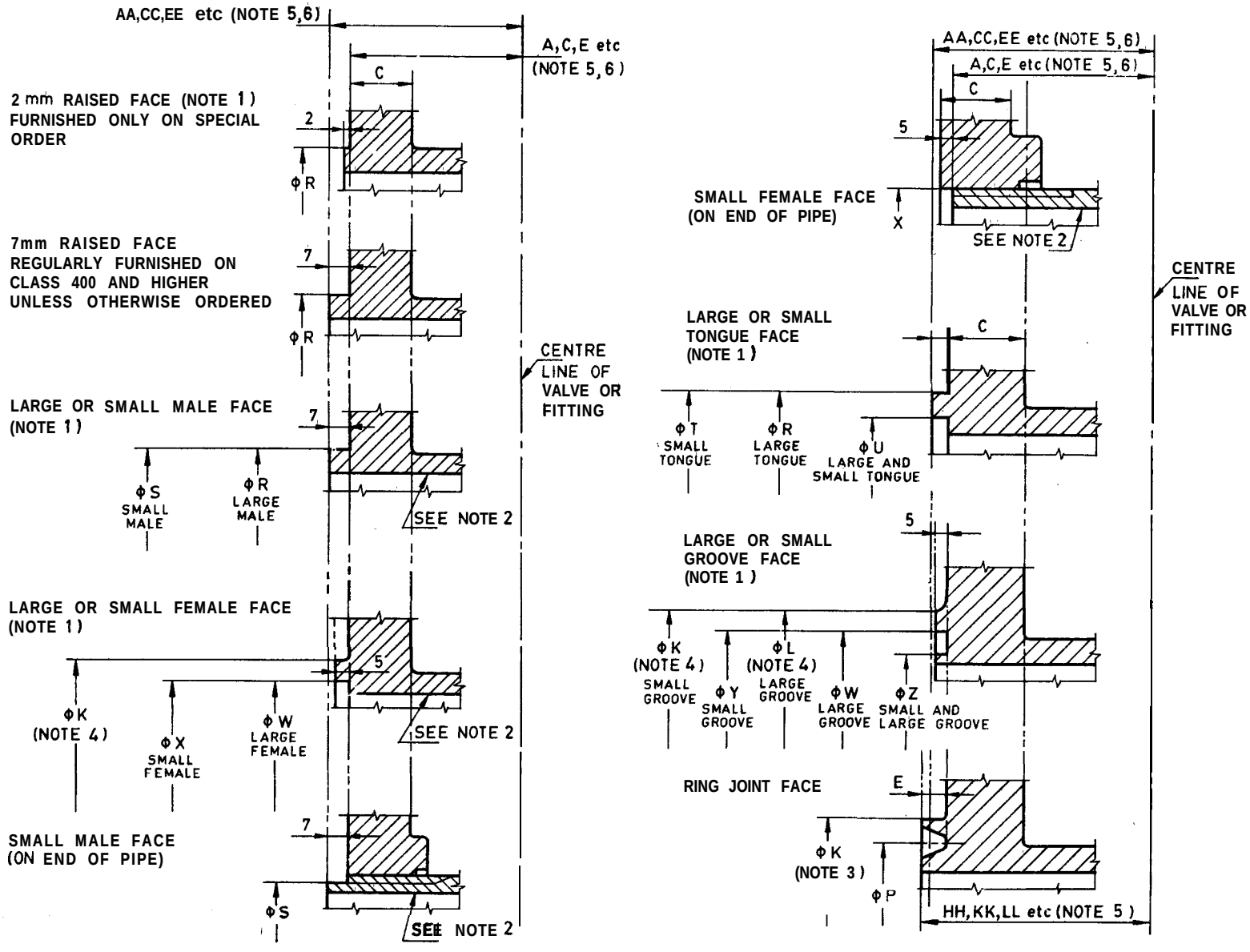
Al! cast and forged flanges and flanged fittings shall have bearing surfaces for bolting which shall be parallel to the flange face within 1°. Any back facing or spot facing required to accomplish parallelism shall not reduce the flange thickness 'C' below the dimensions given in Tables 9 to 15. Diamater of spot facing shall be as given in Annex C.

7.6 Welding **End Preparation for Welding Neck Flanges**

7.6.1 Welding ends are shown in Fig. 11 to17.

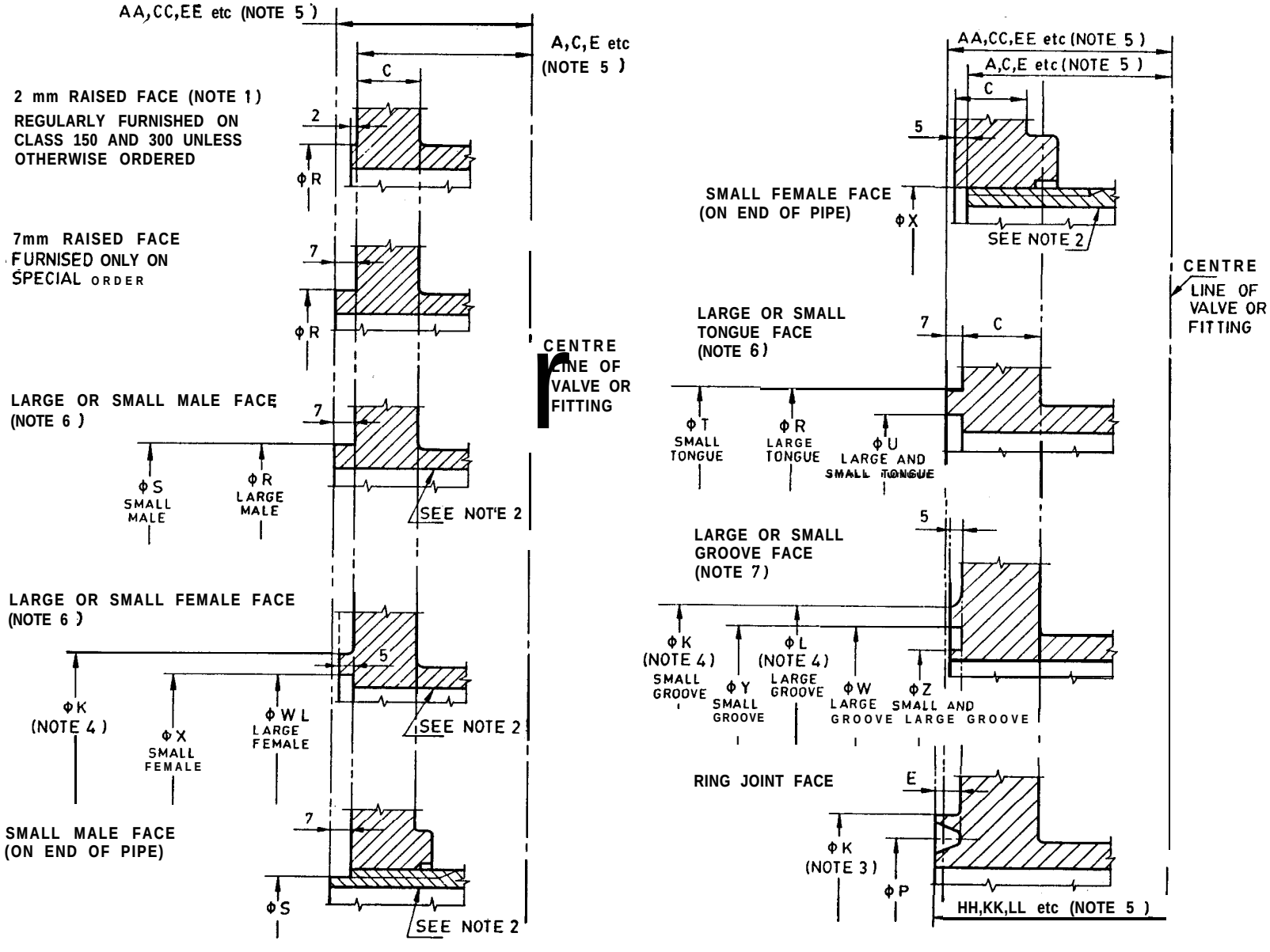
7.6.2 The contours of the outside of the welding neck beyond the welding groove are shown in Fig. 11, 12, 15 and 17.

7.6.3 Cylindrical bores shown in Fig. 11 and 12 are standard unless otherwise specifically ordered to suit the special conditions illustrated in Fig. 13, 14, 15 and 17 read with Table 24.



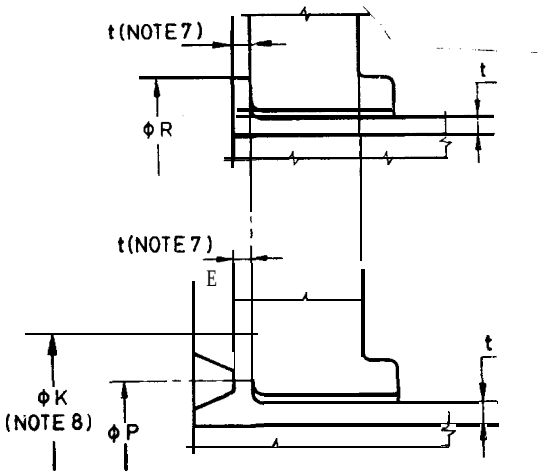
10 A Flange Facings — Class PN 20 and PN 50

FIG. 10 END FLANGE FACINGS AND THEIR RELATIONSHIP TO FLANGE THICKNESS AND CENTER-TO-END DIMENSIONS (*Contd.*)



10 B flange Facings -Class PN 68 and Higher

FIG. 10 END FLANGE FACINGS AND THEIR RELATIONSHIP TO FLANGE THICKNESS AND CENTER-TO-END DIMENSIONS (*Contd.*)



10 C Flange Facings — Lapped Joints

NOTES

1 See Table 22 for dimensions of facings (other than ring-joint) and Table 23 for ring-joint facing.

2 For small male and female joints care should be taken in the use of these dimensions to ensure that the inside diameter **of** fittings or pipe is small enough to permit sufficient bearing surface to prevent the crushing of the gasket (see Table 22). This applies particularly on lines where the joint is made on the end of the pipe. Threaded companion flanges for small male and female joints are furnished with plain face and are threaded with IS 3333 (Part 1) : 1967 threads.

3 See Table 23.

4 See Table 22.

5 See corresponding fittings tables.

6 Large male and female faces and large tongue and groove are not applicable to Class PN 20 because of potential dimensional conflicts.

7 See 6.9.

8 See 6.9.5 and Table 23.

FIG. 10 END FLANGE FACINGS AND THEIR RELATIONSHIP TO FLANGE THICKNESS AND CENTER-IO-END DIMENSIONS (Concluded)

Table 22 Dimensions- of Facings (Other than Ring Joints, All Pressure Rating Classes)
(Clause **6.8.1 and Fig. 10)**

All dimensions in millimetres.

Nominal Size		Outside Diameter			Inside Diameter of Large and Small Tongue	Inside Diameter of Small Male	Outside Diameter			Inside Diameter of Large and Small Groove	Height		Depth of Groove or Female	Minimum Outside Diameter of Raised Portion	
		Raised Face Large Male and Large Tongue	Small Male	Small Tongue			Large Female and Large Groove	Small Female	Small Groove		Raised Face	Large and Small Male and Tongue		Small Female and Groove	Large Female and Groove
DN	NPS	R	S	T	V		W	X	Y	Z				K	L
		2	3	4	5	6	7	8	9	10	11	12	13	14	15
15	1/2	34.9	18.3	35.1	25.4		36.5	19.9	36.5	23.8				44	46
20	3/4	42.9	23.8	42.9	33.3		44.4	25.4	44.4	31.8				52	54
25	1	50.8	30.2	47.8	38.1		52.4	31.8	49.2	36.5				57	62
32	1 1/4	63.5	38.1	57.2	47.6		65.1	39.7	58.7	46.0				67	75
40	1 1/2	73.0	44.4	63.5	54.0		74.6	46.0	65.1	52.4				73	84
50	2	92.1	57.2	82.6	73.0		93.7	58.8	84.1	71.4				92	103
65	2 1/2	104.8	68.3	95.2	85.7		106.4	69.8	96.8	84.1				105	116
80	3	127.0	84.1	117.5	108.0		128.6	85.7	119.1	106.4				127	138
—	3 1/2	139.7	96.8	130.2	120.6		141.3	98.4	131.8	119.1				140	151
100	4	157.2	1095	144.5	131.8		158.8	111.1	146.0	130.2				157	168
125	5	185.7	136.5	173.0	160.3		187.3	138.1	174.6	158.8				186	197
150	6	215.9	161.9	203.2	190.5		217.5	163.5	204.8	188.9				216	227
200	8	269.9	212.7	254.0	238.1		171.5	214.3	255.6	236.5				270	281
250	10	323.8	266.7	304.8	285.8		325.4	268.3	306.4	284.2				324	335
300	12	381.0	317.5	362.0	342.9		382.6	319.1	363.5	341.3				381	392
350	14	412.8	349.2	393.7	374.6		414.3	350.8	395.3	373.1				413	424
400	16	469.9	400.0	4475	425.4		471.5	401.6	449.3	423.9				470	481
450	18	533.4	450.8	511.2	489.0		535.0	452.4	512.8	487.4				533	544
500	20	584.2	501.6	558.8	533.4		585.8	503.2	560.4	531.8				584	59s
600	24	692.2	603.2	666.8	641.4		693.7	604.8	668.3	639.8				692	703

See 6.8.1.1

See Notes 4 and 7

See Notes 5 and 7

See Notes 6 and 7

NOTES

1 For **facing requirements for flanges and flanged fittings** *see* **6.8.1 and Fig. 10.**

2 Fur facing requirements for lapped joints *see* 6.9 and Fig. 10.

3 For facing tolerances, see 9.2

4 Height of raised face is either 1.6 mm or 6.4 mm, see 6.8

5 Height of large and small male and tounges is 6.4 mm.

6 Depth of groove or female is 5 mm.

7 See 6.9 and Fig. 10 for thickness **and outside diameter of laps.**

8 **Raised portion or full face may be furnished** unless otherwise specified on order.

7.6.4 Other welding end preparations furnished by agreement of purchaser and manufacturer do not invalidate compliance with this standard.

7.7 **Reducing Flanges**

7.7.1 *Drilling Outside Diameter, Thickness and Facing Dimensions*

Flange drilling, outside diameter, thickness, and facing are the same as those of the standard flange of the size from which the reduction is being made.

7.7.2 *Threaded and Slip-on Flanges*

The hub dimensions shall be at least as large as those of the standard flange of the size to which the reduction is being made. The hub may be larger or omitted as detailed in Table 8.

7.7.3 *Welding Neck Flanges*

The hub dimensions shall be the same as those of the standard flange of the size to which the reduction is being made.

7.8 **Threads for Threaded Flanges**

Except as provided in Note 2, Fig. 10 threaded flanges shall have standard taper thread conforming to IS 3333 (Part 1) : 1967. The thread shall be concentric with the axis of the flange and variations in alignment shall not exceed 0.5 percent.

7.8.1 PN 20 flanges are made without a counterbore. The threads shall be chamfered approximetely to the major diameter of the thread at the back of the flange at an angle of approximately 45° with the axis of the thread. The chamfer shall be concentric with the thread and shall be included in the measurement of the thread length.

7.8.2 PN 50 and higher pressure flanges are made with a counterbore at the back of the flange. The threads shall be chamfered to the diameter of the counterbore at an angle of approximately 45° with the axis of the threads. The counterbore and chamfer shall be concentric with the thread.

7.8.3 The minimum length of effective thread in reducing flanges shall be at least equal to dimension *T* of the corresponding class of threaded flange as shown in the tables. Threads do not necessarily extend to the face of the flange. See Table 8 for reducing threaded flanges.

7.8.4 The gaging notch of the working gage shall come flush with the bottom of the chamfer in all threaded flanges, and shall be considered as being the intersection of the chamfer cone and the pitch cone of the thread. This depth of chamfer is approximately equal to one-half the pitch of the thread. The maximum allowable thread variation is one turn large or small from the gaging notch.

8 BOLTING

Stud-bolts threaded at both ends or full length, or bolts with heavy hexagonal heads may be used and shall have heavy nuts (see IS 1338: 1966).

8.1 Stud-bolts with a nut at each end are recommended for high temperature service. Stud-bolt lengths specified in respective tables include the thickness of two nuts. The stud-bolt length does not include the height of any point. A point is that part of stud-bolt or a bolt beyond the thread may be chamfered, rounded, or sheared.

8.2 The method of calculating bolt lengths, shall be given in Part 2 of this standard. These lengths are established for the convenience of industry to simplify the assembly of these parts on construction work, but users may select combinations of these bolt lengths to suit their needs.

9 TOLERANCES

9.1 Body

9.1.1 Centte-to-contact *Surfaces (Other than Ring-joint)*

Sizes DN 250 and smaller	± 1 mm
Sizes DN 300 and larger	± 2 mm

9.1.2 *Centre-to-End (Ring Joint)*

Sizes DN 250 and smaller	± 1 mm
Sizes DN 300 and larger	± 2 mm

9.1.3 *Contact Surface-to-Contact Surface (Other than Ring Joint)*

Sizes DN 250 and smaller	± 2 mm
Sizes DN 300 and larger	± 3 mm

9.1.4 *End-to-End (Ring Joint)*

Sizes DN 250 and smaller	± 2 mm
Sizes DN 300 and larger	± 3 mm

9.2 **Facing**

9.2.1 Inside and outside diameter of large and small tongue and groove on female (0.5 mm).

9.2.2 Outside diameter (2 mm) raised face (1.0 mm).

9.2.3 Outside diameter (7 mm) raised face (0.5 mm).

9.2.4 Ring-Joint groove tolerances are shown in Table 23.

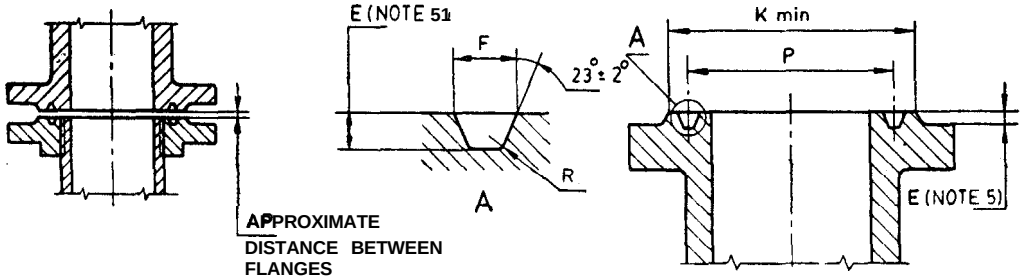
9.3 **Flange Thickness Tolerances**

Sizes DN 450 and smaller	+ 3 mm - 0
Sizes DN 500 larger	+ 4.8 mm - 0

9.4 **Tolerances on Nominal Outside Diameter of Welding End of Welding Neck Flanges**

Sizes DN 125 and smaller	+ 2.4 mm – 0.5 mm
Sizes DN 150 and larger	+ 4.0 mm – 0.8 mm

Table 23 Dimensions of Ring Joint Facings (All Pressure Rating Classes)
(*Clause* 6.8.1 and Fig. 10)



All dimensions in millimetres.

Nominal Size														Groove Number
PN	0	PN 50		PIN 61B		PN 100		PN 150		PN 250		PN 420		
DN	NPS	DN	NPS	DN	NPS	DN	NPS	DN	NPS	DN	NPS	DN	NPS	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
-	—	15	1/2	—	—	15	1/2	—	—	—	—	—	—	R11
—	—	—	—	—	—	—	—	—	—	15	1/2	—	—	12
—	—	20	1/4	—	—	20	1/4	—	—	—	—	15	1/2	13
—	—	—	—	—	—	—	—	—	—	20	1/4	—	—	14
25	1	—	—	—	—	—	—	—	—	—	—	—	—	15
—	—	25	1	—	—	25	1	—	—	25	1	20	3/4	16
32	1 1/4	—	—	—	—	—	—	—	—	—	—	—	—	17
—	—	32	1 1/4	—	—	32	1 1/4	—	—	32	1 1/4	25	1	18
40	1 1/2	—	—	—	—	—	—	—	—	—	—	—	—	19
—	—	40	1 1/2	—	—	40	1 1/2	—	—	40	1 1/2	—	—	20
—	—	—	—	—	—	—	—	—	—	—	—	32	1 1/4	21
50	2	—	—	—	—	—	—	—	—	—	—	—	—	22
—	—	50	2	—	—	50	2	—	—	—	—	40	1 1/2	23
—	—	—	—	—	—	—	—	—	—	50	2	—	—	24
65	2 1/2	—	—	—	—	—	—	—	—	—	—	—	—	25
—	—	6.5	2 1/2	—	—	65	2 1/2	—	—	—	—	50	2	26
—	—	—	—	—	—	—	—	- -	—	65	2 1/2	—	—	27
—	—	—	—	—	—	—	—	—	—	—	—	65	2 1/2	28
80	3	—	—	—	—	—	—	—	—	—	—	—	—	29
—	—	—	—	—	—	—	—	—	—	—	—	—	—	30
—	—	80t	3	—	—	80+	3	80+	3	—	—	—	—	31
—	—	—	—	—	—	—	—	—	—	—	—	80	3	32
90	3 1/2	—	—	—	—	—	—	—	—	—	—	—	—	33
—	—	90	3 1/2	—	—	90	3 1/2	—	—	—	—	—	—	34
—	—	—	—	—	—	—	—	—	—	80	3	—	—	35
100	4	—	—	—	—	—	—	—	—	—	—	—	—	36
—	—	100	4	100	4	100	4	100	4'	—	—	—	—	37
—	—	—	—	—	—	—	—	—	—	—	—	100	4	38
—	—	—	—	—	—	—	—	—	—	100	4	—	—	39
125	5	—	—	—	—	—	—	—	—	—	—	—	—	40
—	—	12.5	5	125	5	125	5	125	5	—	—	—	—	41
—	—	—	—	—	—	—	—	—	—	—	—	125	5	42
150	6	—	—	—	—	—	—	—	—	—	—	—	—	43
—	—	—	—	—	—	—	—	—	—	125	5	—	—	44
—	—	150	6	150	6	150	6	150	6	—	—	—	—	45

Table 23 (Continued)

All dimensions in millimetres.

Groove Dimensio				Diameter of Raised Portion *K*					Approximate Distance Between Flanges						
Pitch Diam-eter P ± 0.13	Depth E [6] +0.40 −0.00	Width F ± 0.20	Radius at Bottom R, Max	N 20	N 50 N 68 N 100	N 150	PN 250	PN 420	E N 20	N 50	N 68	N 100	PN 150	PN 250	N 420
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
34.11	5.56	7.14	0.8	—	51.0	—	—	—	—	3	—	3	—	—	—
39.69	6.35	8.74	0.8	—	—	—	60.5	—	—	—	—	—	—	4	—
42.86	6.35	8.74	0.8	—	63.5	—	—	65.0	—	4	—	4	—	—	4
44.45	6.35	8.74	0.8	—	—	—	66.5	—	—	—	—	—	—	4	—
47.63	6.35	8.74	0.8	63.5	—	—	—	—	4	—	—	—	—	—	—
50.80	6.35	8.74	0.8	—	70.0	—	71.5	73.0	—	4	—	4	—	4	4
57.15	6.35	8.74	0.8	73.0	—	—	—	—	4	—	—	—	—	—	—
60.33	6.35	8.74	0.8	—	79.5	—	81.0	82.5	—	4	—	4	—	4	4
65.09	6.35	8.74	0.8	82.5	—	—	—	—	4	—	—	—	—	—	—
68.26	6.35	8.74	0.8	—	90.5	—	92.0	—	—	4	—	4	—	4	—
72.23	7.92	11.91	0.8	—	—	—	—	102	—	—	—	—	—	—	3
82.55	6.35	8.74	0.8	102	—	—	—	—	4	—	—	—	—	—	—
82.55	7.92	11.91	0.8	—	108	—	—	114	—	6	—	5	—	—	3
95.25	7.92	11.91	0.8	—	—	—	124	—	—	—	—	—	—	3	—
101.60	6.35	8.74	0.8	121	—	—	—	—	4	—	—	—	—	—	
101.60	7.92	11.91	0.8	—	127	—	—	133	—	6	—	5	—	—	3
107.95	7.92	11.91	0.8	—	—	—	137	—	—	—	—	—	—	3	
111.13	9.52	13.49	0.8	—	—	—	—	149	—	—	—	—	—	—	3
114.30	6.35	8.74	0.8	133	—	—	—	—	4	—	—	—	—	—	—
117.48	7.92	11.91	0.8	—	—	—	—	—	—	—	—	—	—	—	
123.83	7.92	11.91	0.8	—	146	156	—	—	—	6	—	5	4	—	
127.00	9.52	13.49	1.5	—	—	—	—	168	—	—	—	—	—	—	3
131.76	6.35	8.74	0.8	154	—	—	—	—	4	—	—	—	—	—	
131.76	7.92	11.91	0.8	—	159	—	—	—	—	6	—	5	—	—	
136.53	7.92	11.91	0.8	—	—	—	168	—	—	—	—	—	—	3	
149.23	6.35	8.74	0.8	171	—	—	—	—	4	—	—	—	—	—	—
149.23	7.92	11.91	0.8	—	175	181	—	—	—	6	6	5	4	—	—
157.16	11.13	16.66	1.5	—	—	—	—	203	—	—	—	—	—	—	4
161.93	7.92	11.91	0.8	—	—		194	—	—	—	—	—	—	3	—
171.45	6.35	8.74	0.8	194	—	—	—	—	4	—	—	—	—	—	—
180.98	7.92	11.91	0.8	—	210	216	—	—	—	6	6	5	4	—	—
190.50	12.70	19.84	1.5	—	—	—	—	241	—	—	—	—	—	—	4
193.68	6.35	8.74	0.8	219	—	—	—	—	4	—	—	—	—	—	—
193.68	7.92	11.91	0.8	—	—	—	229	—	—	—	—	—	—	3	—
211.13	7.92	11.91	0.8	—	241	241	—	—	—	6	6	5	4	—	—

Table 23 (*Continued*)

All dimensions in millimetres.

Nominal Size														Groove Number
PN 10		PN 10		PN 16		PN 20		PN 50		PN 50		PN 420		
DN	NPS	DN	NPS	DN	NPS	DN	NPS	DN	NPS	DN	NPS	DN	NPS	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
—	—	—	—	—	—	—	—	—	—	150	6	—	—	R46
—	—	—	—	—	—	—	—	—	—	—	—	150	6	47
200	8	—	—	—	—	—	—	—	—	—	—	—	—	48
—	—	200	8	200	8	200	8	200	8	—	—	—	—	49
—	—	—	—	—	—	—	—	—	—	200	8	—	—	50
—	—	—	—	—	—	—	—	—	—	—	—	200	8	51
250	10	—	—	—	—	—	—	—	—	—	—	—	—	52
—	—	250	10	250	10	250	10	250	10	—	—	—	—	53
—	—	—	—	—	—	—	—	—	—	250	10	—	—	54
—	—	—	—	—	—	—	—	—	—	—	—	250	10	55
300	12	—	—	—	—	—	—	—	—	—	—	—	—	56
—	—	300	12	300	12	300	12	300	12	—	—	—	—	57
—	—	—	—	—	—	—	—	—	—	300	12	—	—	58
350	14	—	—	—	—	—	—	—	—	—	—	—	—	59
—	—	—	—	—	—	—	—	—	—	—	—	300	12	60
—	—	350	14	350	14	350	14	—	—	—	—	—	—	61
—	—	—	—	—	—	—	—	350	14	—	—	—	—	62
—	—	—	—	—	—	—	—	—	—	350	14	—	—	63
400	16	—	—	—	—	—	—	—	—	—	—	—	—	64
—	—	400	16	400	16	400	16	—	—	—	—	—	—	65
—	—	—	—	—	—	—	—	400	16	—	—	—	—	66
—	—	—	—	—	—	—	—	—	—	400	16	—	—	67
450	18	—	—	—	—	—	—	—	—	—	—	—	—	68
—	—	450	18	450	18	450	18	—	—	—	—	—	—	69
—	—	—	—	—	—	—	—	450	18	—	—	—	—	70
—	—	—	—	—	—	—	—	—	—	450	18	—	—	71
500	20	—	—	—	—	—	—	—	—	—	—	—	—	72
—	—	500	20	500	20	500	20	—	—	—	—	—	—	73
—	—	—	—	—	—	—	—	500	20	—	—	—	—	74
—	—	—	—	—	—	—	—	—	—	500	20	—	—	75
600	24	—	—	—	—	—	—	—	—	—	—	—	—	76
—	—	600	24	600	24	600	24	—	—	—	—	—	—	77
—	—	—	—	—	—	—	—	600	24	—	—	—	—	78
—	—	—	—	—	—	—	—	—	—	600	24	—	—	79

Table 23 *(Concluded)*

All dimensions in millimetres.

Groove Dimensions				Diameter of Raised Portion *K*					Approximate Distance Between Flanges						
Pitch Diameter P ± 0.13	Depth E [6] +0.40 −0.00	Width F ± 0.20	Radius at Bottom R, Max	PN 20	PN 50 PN 68 PN 100	PN 150	PN 250	PN 420	PN 20	PN 50	PN 68	PN 100	PN 150	PN 250	PN 420
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
211.14	9.52	13.49	1.5	—	—	—	248	—	—	—	—	—	—	3	—
228.60	12.70	19.84	1.5	—		—	—	279	—	—	—	—		—	4
247.65	6.35	8.74	0.8	273	—	—	—	—	4	—	—	—		—	—
269.88	7.92	11.91	0.8	—	302	308	—	—	—	6	6	5	4	—	—
269.88	11.13	16.66	1.5	—	—	—	318	—	—	—	—	—		4	—
279.40	14.27	23.01	1.5	—	—	—	—	340	—	—	—	—	—	—	5
304.80	6.35	8.74	0.8	330	—	—	—	—	4	—	—	—	—	—	—
323.85	1.92	11.91	0.8	—	356	362	—	—	—	6	6	5	4	—	—
323.85	11.13	16.66	1.5	—	—	— —	371	—	—	—	—	—	—	4	—
342.90	17.48	30.18	2.4	—	—	—	—	425	—	—	—	—	—	—	6
381.00	6.35	8.74	0.8	406	—	—	—	—	4	—	—	—	—	—	
381.00	1.92	11.91	0.8	—	413	419	—	—	—	6	6	5	4	—	
381.00	14.27	23.01	1.5	—	—	—	438	—	—	—	—	—	—	5	
396.88	6.35	8.74	0.8	425	—	—	—	—	3	—	—	—	—	—	
406.40	17.48	33.32	2.4	—	—	—	—	495	—	—	—	—	—	—	
419.10	7.92	11.91	0.8	—	457	—	—	—	—	6	6	5	—	—	
419.10	11.13	16.66	1.5	—	—	467	—	—	—	—	—	—	4	—	
419.10	15.88	26.97	2.4	—	—	—	489	—	—	—	—	—	—	6	
454.03	6.35	8.74	0.8	483	—	—	—	—	3	—	—	—	—	—	
469.90	1.92	11.91	0.8	—	508	—	—	—	—	6	6	5	—	—	
469.90	11.13	16.66	1.5	—	—	524	—	—	—	—	—	—	4	—	
469.90	17.48	30.18	2.4	—	—	—	546	—	—	—	—	—	—	8	
517.53	6.35	8.74	0.8	546	—	—	—	—	3	—	—	—	—	—	
533.40	7.92	11.91	0.8	—	575	—	—	—	—	6	6	5	—	—	
533.40	12.70	19.84	1.5	—	—	594	—	—	—	—	—	—	5	—	
533.40	17.48	30.18	2.4	—	—	—	613	—	—	—	—	—	—	8	
558.80	6.35	8.74	0.8	597	—	—	—	—	3	—	—	—	—	—	
584.20	9.52	13.49	1.5	—	635	—	—	—	—	6	6	5	—	—	
584.20	12.70	19.84	1.5	—	—	648	—	—	—	—	—	—	5	—	
584.20	17.48	33.32	2.4	—	—	—	673	—	—	—	—	—		10	
673.10	6.35	8.74	0.8	711	—	—	—	—	3	—	—	—		—	
692.15	11.13	16.66	1.5	—	749	—	—	—	—	6	6	6		—	
692.15	15.811	26.95	2.4	—	—	712	—	—	—	—	—	—	6	—	
692.15	20.62	36.53	2.4	—	—	—	794	—	—	—	—	—	—	11	

NOTES

1 For ring joints with lapped flanges in PN 50 and PN 100, ring and groove number R 30 are used instead of R31.

2 For facing requirements for flanges and flanged fittings (*see* Fig. 10 and 6.8).

3 For facing requirements for lapped joints (*see* 6.9 and Fig. 10).

4 Use PN 100 in sizes DN 15 to 80 for PN 68.

5 Use class PN 250 in sizes DN 15 to 65 for PN 150.

6 Height of raised portion is equal to the depth of groove *'E'*, but is not subject to the tolerance for 'E'. Former full-face contour may be used (see 5.6).

WELDING ENDS
(WELDING NECK FLANGES)

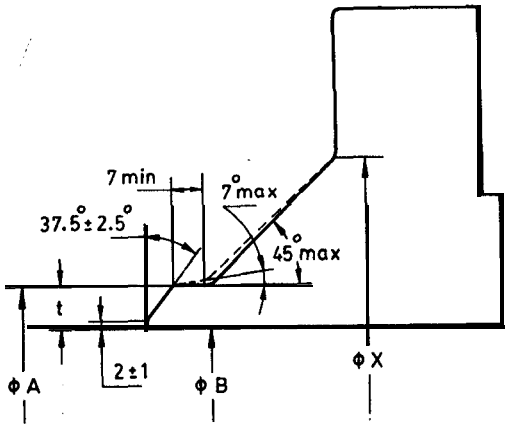


FIG. 11 BEVEL FOR WALL THICKNESS (*t*)
(5 TO 22 mm INCLUSIVE)

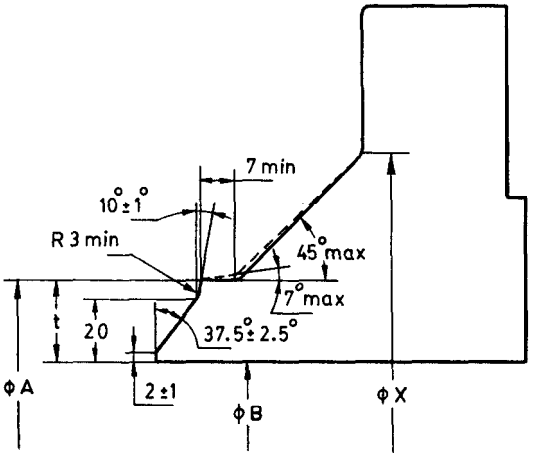


FIG. 11 BEVEL FOR WALL THICKNESS (t)
(GREATER THAN 22 mm) (see NOTE 2)

A = Nominal outside diameter of pipe (mm)
B = Nominal inside diameter of pipe (mm)
t = Nominal wall thickness of pipe (mm)

NOTES'

1 See 7.6, 7.7 and 9.5 for details and tolerances.

2 See Fig. 13 and 14 for additional details of welding ends.

3 When the thickness of the hub at the bevel is greater than that of pipe to which the flange is joined and the additional thickness is provided on the outside diameter, a taper weld having a slope not exceeding 1 to 3 may be employed or, alternatively, thegreateroutsidediameter maybe tapered, at thesamemaximumslopeorless, from a point on thewelding level equal to the outside diameter of the mating pipe. Similarly, when the greater thickness is provided on the inside of the flange, it shall be taper-bored from the welding end at a slope not exceeding 1 to 3.

4 When flanges covered by this standard are intended for services with light wall, highestrength pipe, the thickness of the hub at the bevel may be greater than that of thepipe to which the flange is joined. Under these conditions a single taper hub may be provided and the outside diameter of the hub at the base (Dimension *X*) may also be modified.

5 The additional thickness may be provided on either inside or outside or partially on each side, but thtotal additional thickness shall not exceed one-half times the nominal wall thickness of intended mating pipe (see Fig 15, 16 and 17).

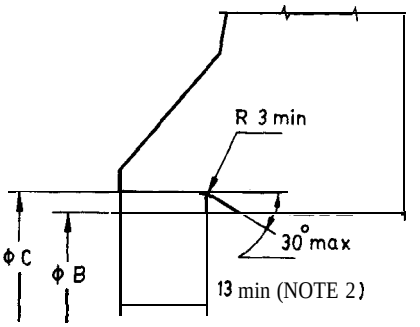


FIG. 13 INSIDE *CONTOUR* FOR USE WITH RECTANGULAR BACKING RING

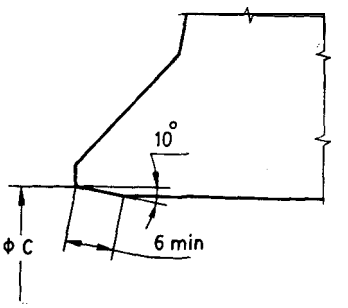


FIG. 14 INSIDE *CONTOUR* FOR USE WITH TAPER BACKING RING

A = Nominal **outside diameter of** welding end (mm)
B = Nominal inside diameter of pipe = $A - 2t$ (mm)
c = $(A - 0.79 - 1.75\ t - 0.25$ mm)
t = Nominal wall thickness of pipe (mm)
1.75 t = 87.5% of nominal wall multiplied by two to convert into terms of diameter
0.25 = Plus tolerance on diameter C
0.79 = Minus tolerance on outside diameter of pipe.

NOTES
1 See 7.6, 7.7 and 9.5 for details and tolerances.
2 13 mm depth based on use of (19 mm) wide backing ring.
3 See Fig. 11 and Fig. 12 for welding end details of welding neck flanges.
4 For dimension see Table 24.

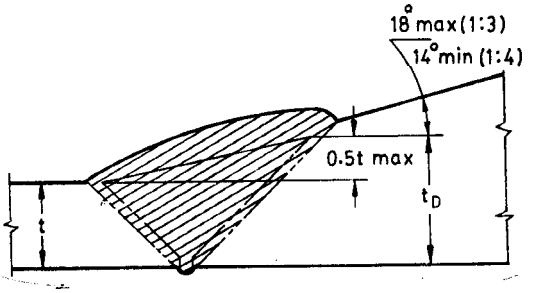


FIG. 1.5 BEVEL FOR OUTSIDE THICKNESS

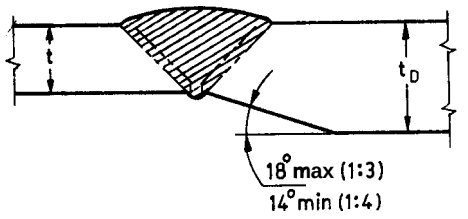


FIG. 16 BEVEL FOR INSIDE THICKNESS

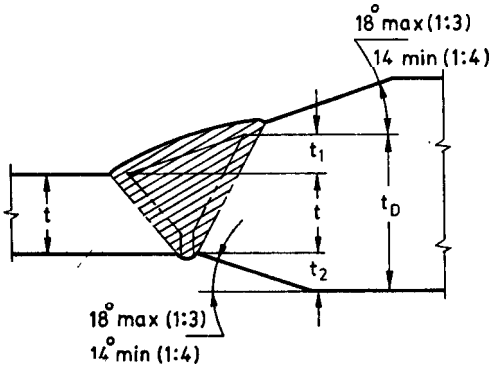


FIG. 17 BEVEL FOR COMBINED THICKNESS

NOTES TO FIG. 15.16 AND 17

1 When the materials joined have equal minimum specified yield strength, there shall be no restriction on the minimum slope.

2 Neither t_1, t_2 nor their sum ($t_1 + t_2$) shall exceed $0.5t$.

3 When the minimum specified yield strengths of the sections to be joined are unequal, the value of t_D shall atleast equal 't' times the ratio of minimum specified yield strength of the pipe to minimum specified yield strength of the flange.

4 Welding shall be in accordance with the applicable code.

Table 24 Dimensions of Welding Ends
(Clause 7.6.3 and *Fig.* 11 to 17)

All dimensions in millimetres.

Nominal Size		Wall Thickness [1] or Schedule	A [2]	B [2]	C [2),3),4]	t [2),4]
DN	NPS					
1	2	3	4	5	6	7
65	$2\frac{1}{2}$	40	73.0	62.7	62.95	5.15
		80		59.0	59.70	7.00
		160		54.0	55.30	9.55
		xxs		45.0	47.45	14.00
80	3	40	88.9	17.9	78.25	5.50
		80		73.7	74.50	7.60
		160		66.7	68.40	11.15
		xxs		58.4	61.20	15.25
	$3\frac{1}{2}$	40	101.6	90.1	90.55	5.75
		80		85.4	86.40	8.10
100	4	40	114.3	102.3	102.70	6.00
		80		91.2	98.25	8.55
		120		92.0	93.80	11.15
		160		81.3	89.65	13.50
		XXS		80.1	83.30	17.10
125	5	40	141.3	128.2	128.80	6.55
		80		122.0	123.60	9.55
		120		115.9	118.05	12.70
		160		109.6	112.25	15.90
		xxs		103.2	106.90	19.05
150	6	40	168.3	154.1	154.80	7.10
		80		146.3	148.05	10.95
		120		139.7	142.25	14.25
		160		131.8	135.30	18.25
		xxs		124.4	128.85	21.95
200	8	40	219.1	202.7	203.70	8.20
		60		198.5	199.95	10.30
		80		193.7	195.80	12.70
		100		189.0	191.65	15.05
		120		182 6	186.10	18.25
		140		177.8	181.95	20.60
		xxs		174.6	171.15	22.25
		160		173.1	177.75	23.00
250	10	40	273.1	254.5	255.80	9.25
		60		247.7	249.80	12.70
		80		242.9	245 .60	15.05
		100		236.6	240.10	18.25
		120		230.2	234.55	21.40
		140		222.3	227.55	25.40
		160		215.9	222.00	28.60
300	12	STD	323.9	304.8	306.15	9.55
		40		303.2	304.75	10.30
		xs		298.5	300.60	12.70
		60		295.3	297.80	14.25
		80		289.0	292.30	17.45
		100		281.0	285.35	21.40
		120		273.1	278.35	25.40
		140		266.1	272.80	28.60
		160		257.2	264.50	33.30

Table 24 *(Concluded)*

Nominal Size DN	NPS	Wall Thickness[1] or Schedule	A[2]	B[2]	C[2),3),4]	t[2),4]
1	2	3	4	5	6	7
350	14	STD	355.6	336.6	337.90	9.55
		40		333.3	335.10	11.15
		x s		330.2	332.35	12.70
		60		325.5	328.20	15.05
		80		317.5	321.20	19.05
		100		308.0	312.90	23.80
		120		300.1	305.95	27.75
		140		292.1	299.00	31.75
		160		284.2	292.05	35.70
400	16	STD	406.4	387.4	388.70	9.55
		40		381.0	383.15	12.70
		60		373.1	376.20	16.65
		80		363.6	367.90	21.40
		100		354.0	359.55	26.20
		120		344.5	351.20	30.95
		140		333.3	341.45	36.55
		160		325.5	334.55	40.45
450	18	STD	457.2	438.2	439.50	9.55
		x s		431.8	433.95	12.70
		40		428.7	431.15	14.25
		60		419.1	422.80	19.05
		80		409.6	414.50	23.80
		100		398.5	404.75	29.35
		120		387.4	395.05	34.95
		140		377.9	386.70	39.65
		160		366.7	377.00	45.25
500	20	STD	508.0	489.0	490.30	9.55
		x s		482.6	484.75	12.70
		40		477.9	480.60	15.05
		60		466.8	470.85	20.60
		80		455.6	461.15	26.20
		100		443.0	450.00	32.55
		120		431.8	440.30	38.10
		140		419.1	429.15	44.45
		160		408.0	419.50	50.00
600	24	STD	609.6	590.6	591.90	9.55
		x s		584.2	586.35	12.70
		30		581.1	583.55	14.25
		40		574.7	578.05	17.45
		60		560.4	565.55	24.60
		80		547.7	554.40	30.95
		100		531.8	540.50	38.90
		120		517.6	528.00	46.00
		140		504.9	516.90	52.35
		160		490.6	504.40	59.50

NOTES

1 STD = Standard Wall Thickness.
XS = Extra Strong Wall Thickness.
XXS = Double. Extra Strong Wall Thickness.

2 For tolerances (*see* 9.5).

3 It should be recognized that there is no fixed relation between pressure classes and pipe schedules.

4 When the wall thickness is less than 14.33 mm, it may be necessary to provide additional material by weld-deposition in order to be able to machine to the 'C' dimensions.

5 This table covers a few popular sizes only. User may calculate dimensions for other sizes based on formula given with Fig. 13 and 14.

9.5 Nominal Inside Diameter of Welding Ends

Ofwelding neck flanges and smaller bore of socket welding flanges (Dimensions *B* in the referenced Figures).

(*See Fig. 11 and 12*)

Sizes DN 250 and smaller	0.8 mm
Sizes DN 300 to 450 and larger	1.6 mm
Sizes DN 500 and larger	$^{+3.2}_{-1.6}$ mm

(See *Fig. 13*)

Sizes DN 250 and smaller	t o − 0.8 mm
Sizes DN 300 and larger	t o − 1.6 mm

9.6 **Bore of Backing Ring**

Of welding ucck tlanges (Dimensions C of Fig. 13 aud 14):

All Sizes	$^{+0.25}_{-0}$ mm

9.7 **Thickness of Hub**

Regardless of tolerances specified for dimeusious A and *B*, the tbickuess of hub at the welding eud shall uever be less tbau 87.5 percent of the nominal tbickuess of the pipe to which the tlange is to be attached.

9.8 **Overall Length of Hub on Welding Neck Flanges**

Sizes DN 250 and smaller	2 mm
Sizes DN 300 and larger	3 mm

9.9 Bore of Flanges

9.9.1 *Lapped, Slip-on and Socket-Welding Flanges*

Sizes DN 250 and smaller	$^{+1}_{-0}$ mm
Sizes DN 300 and larger	$^{+2}_{-0}$ mm

9.9.2 *Counterbore, Threaded Flanges*

Sizes DN 250 and smaller	$^{+1}_{-0}$ mm
Sizes DN 300 and larger	$^{t2}_{-0}$ mm

9.10 **Drilling and Facing Tolerances**

9.10.1 *Belt Circle Ditrmeter, 2* mm.

9.10.2 *Centre-to-Cenrre of Adjacent Bold Circle Holes, 0.8* mm.

9.11 Eccentricity

Betweeu bolt circle diameter and macbiued facing diameters:

Sizes DN 65 and smaller	1 mm
Sizes DN 80 and larger	2 mm

10 **Test**

10.1 Flanged Fitting Testing

Each flauged fitting shall be given a hydrostatic shell test as specified in 10.3.

10.2 **Flauge Testing**

Flanges are not required to be hydrostatically tested. Flanged joints may be subjected to system hydrostatic tests at pressures no less than 1.5 times the 38°C rating rounded off to the next higher 1 bar increment. Test pressures are shown in Table 2.5.

10.3 **Hydrostatic Shell Test**

The hydrostatic shell test pressure for flanged fittings shall be no less than 1.5 times the 38°C rating rounded off to the next higher 1 bar increment. Test pressures are shwon in Table 25.

10.4 The test shall be made with water, which may contain a corrosion inhibitor, with kerosene, or with another suitable fluid provided its viscosity is no greater than that of water, at a test temperature not above 52°C.

10.5 The test duration shall be a minimum of I minute for fittings DN 50 aud smaller, 2 minutes for fittings DN 65 - 200 and 3 minutes for fittings DN 250 and larger.

10.6 No visible leakage is permitted through the pressure boundary wall.

Table 25 Hydrostatic Test Pressures

(*Clauses* 10.2 *and* 10.3)

Material Group NO.	Shell Test Pressures bv Class -All Pressures are Gage													
	PN 20 / Class 1.50		PN 50 / Class 300		PN 68 / Class 400		PN 100 / Class 600		PN 150 / Class 900		PN 250 / Class 1500		PN 420 / Class 2500	
	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi	bar	psi
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1.1	30	450	78	1125	104	1500	154	2225	230	3350	383	5575	639	9275
1.2	30	4.50	78	1125	104	1500	156	2250	233	3375	388	5625	647	9375
1.3	28	400	72	1050	96	1400	144	2100	216	3150	360	5225	599	8700
1.4	25	375	64	950	86	1250	128	1875	192	2775	320	4650	532	7725
1.5	28	400	72	1050	96	1400	144	2100	216	3150	360	5225	599	8700
1.7	30	450	78	1125	104	1500	156	2250	233	3375	388	5625	647	9375
1.9	30	450	78	1125	104	1500	156	2250	233	3375	388	5625	647	9375
1.10	30	450	78	1125	104	1500	156	2250	233	3375	388	5625	647	9375
1.13	30	450	78	1125	104	1500	156	2250	233	3375	388	5625	647	9375
1.14	30	450	78	1115	104	1500	156	2250	233	3375	388	5625	647	9375
2.1	29	425	75	1100	100	1450	149	2175	224	3250	373	5400	621	9000
2.2	29	425	75	1100	100	1450	149	2175	224	3250	373	5400	621	9000
2.3	24	350	63	900	83.	1200	125	1800	187	2700	311	4500	517	7500
2.4	29	425	75	1100	100	1450	149	2175	224	3250	373	5400	621	9000
2.5	29	425	75	1100	100	1450	149	2175	224	3250	373	5400	621	9000
2.6	27	400	70	1025	93	1350	140	2025	209	3025	348	5050	580	8400
2.7	27	400	70	1025	93	1350	140	2025	209	3025	348	5050	580	8400

NOTE -These pressures are subject to the limitations of **10.**

ANNEX A
(Foreword)

DIMENSIONS OF SEAMLESS AND WELDED STEEL PIPE

All dimensions in millimetres

Nominal Pipe Size		Outside Diameter	Nominal Wall Thickness						
DN	(NPS)		Schedule 5S	Schedule 10s	Schedule 10	Schedule 20	Schedule 30	Schedule 40s	Standard wall
1		2	3	4	5	6	7	8	9
3	(1/8)	10.3	—	1.24	—	—	—	1.73	1.73
6	(1/4)	13.7	—	1.65	—	—	—	2.24	2.24
20	(3/4)	17.1	—	1.65	—	—	—	2.31	2.31
15	(1/2)	21.3	1.65	2.11	—	—	—	2.71	2.77
20	(3/4)	26.7	1.65	2.11	—	—	—	2.87	2.87
25	(1)	33.4	1.65	2.77	—	—	—	3.38	3.38
(32)	(1 1/4)	42.2	1.65	2.77	—	—	—	3.56	2.56
40	(1 1/2)	48.3	1.65	2.77	—	—	—	3.68	3.68
50	(2)	60.3	1.65	2.77	—	—	—	3.91	3.91
6.5	(2 1/2)	73.0	2.11	3.05	—	—	—	5.16	5.16
80	(3)	88.9	2.11	3.05	—	—	—	5.49	5.49
(90)	(3 1/2)	101.6	2.11	3.05	—	—	—	5.74	5.74
100	(4)	114.3	2.11	3.05	—	—	—	6.02	6.02
(125)	(5)	141.3	2.77	3.40	—	—	—	6.55	6.55
190	(6)	168.3	2.77	3.40	—	—	—	7.11	7.11
200	(8)	219.1	2.77	3.76	—	6.35	7.04	8.18	8.18
250	(10)	273.0	3.40	4.19	—	6.35	7.80	9.27	9.27
300	(12)	323.9	3.96	4.57	—	635	8.38	9.52	9.52
350	(14)	355.6	3.96	4.78	6.35	7.92	9.52	—	9.52
400	(16)	406.4	4.19	4.78	6.35	7.92	9.52	—	9.52
450	(18)	457.0	4.19	4.78	6.35	7.92	11.13	—	9.52
500	(20)	508.0	4.78	5.54	6.35	9.52	12.70	—	9.52
550	(22)	599.0	4.78	5.54	6.35	9.52	12.70	—	9.521)
600	(24)	610.0	5.54	6.35	6.35	9.52	14.27	—	9.521
650	(26)	660.0	—	—	7.92	12.70	—	—	9.52
700	(28)	711.0	—	—	7.92	12.70	15.88	—	9.52
750	(30)	762.0	6.35	7.92	7.92	12.70	15.88	—	9.52
800	(32)	813.0	—	—	7.92	12.70	15.88	—	9.52)
850	(34)	864.0	—	—	7.92	12.70	15.88	—	9.52
900	(36)	914.0	—	—	7.92	12.70	15.88	—	9.52

ANNEX A (Concluded)

All dimensions in millimetres.

:hedule 40	Schedule 60	Schedule 80S	Extra Strong	Schedule 80	Schedule 100	Schedule 120	Schedule 140	Schedule 160	Double Extra Strong
10	11	12	13	14	15	16	17	18	19
1.73	—	2.41	2.41	2.41	—	—	—	—	—
2.24	—	3.02	3.02	3.02	—	—	—	—	—
2.31	—	3.20	3.20	3.20	—	—	—	—	—
2.77	—	3.73	3.73	3.73	—	—	—	4.78	7.47 [1]
2.87	—	3.91	3.91	3.91	—	—	—	5.56	7.82 [1]
3.38	—	4.55	4.55	4.55	—	—	—	6.35	9.09”
3.56	—	4.85	4.85	4.85	—	—	—	6.35	9.70’)
3.68	—	5.08	5.08	5.08	—	—	—	7.14	10.16”
3.91	—	5.54	5.54	5.54	—	—	—	8.74	11.07”
5.16	—	7.01	7.01	7.01	—	—	—	9.52	14.02”
5.49	—	7.62	7.62	7.62	—	—	—	11.13	15.24”
5.74		8.08	8.08	8.08	—	—	—	—	—
6 . 0 2	—	8.56	8.56	8.56	—	11.13	—	13.49	17.12’)
6.55	—	9.52	9.52	9.52	—	12.70	—	15.88	19.05’)
7.11	—	10.97	10.97	10.97	—	14.27	—	18.26	21.95’)
8.18	10.31	12.70 ,	12.70	12.70	15.09	18.26	20.62	23.01	22.221)
9.27	12.70	12.70	12.70	15.09	18.26	21.44	25.40	28.58	25.40
10.31	14.27	12.70	12.70[1]	17.47	21.44	25.40	28.58	33.34	25.40
11.13	15.09	—	12.70’)	19.05	23.82	27.79.	31.75	35.71	—
12.70	16.64	—	12.70	21.44	26.19	30.96	36.52	40.49	—
14.27	19.05	—	12.70[1]	23.82	29.36	34.92	39.69	45.24	—
15.09	20.62	—	12.70	26.19	32.54	38.10	44.45	50.01	—
15.88	22.22	—	12.70	28.58	34.92	41.28	47.62	53.98	—
17.48	24.61	—	12.70’)	30.96	38.89	46.02	52.39	59.54	—
—	—	—	12.70	—	—	—	—	—	—
—	—	—	12.70	—	—	—	—	—	—
—	—	—	12.70	—	—	—	—	—	—
17.48	—	—	12.70	—	—	—	—	—	—
17.48	—	—	12.70	—	—	—	—	—	—
19.05	—	—	12.70	—	—	—	—	—	—

NOTES

1 Except these Standard, Extra Strong and Double Extra Strong wall thickness have pipe of corresponding wall thickness listed under one of the schedule numbers.

2 The tolerance on outside diameter and wall thickness shall be in accordance with the relevant Indian Standards.

3 Schedule 5S, 10S, 40S, and 80S apply to austenitic chromium-nickel steel pipe only.

4 The use of sizes in paranthesis should be avoided: these sizes will be deleted in future editions.

ANNEXB

(*Clause 1)*

Table B-l Rating Ceiling Values

(Metric Units)

Temperature in °C	Gage Working Pressure in bar by Rating Number						
	PN 20	PN 50	PN 68	PN 100	PN 150	PN 250	PN 420
-29 To 38	20.0	51.7	69.0	103.4	155.2	258.6	431.0
50	19.5	51.7	69.0	103.4	155.2	258.6	431.0
loo	17.7	51.5	68.7	103.1	154.6	257.7	429.5
150	15.8	50.2	66.9	100.4	150.6	251.0	418.3
200	14.0	48.8	65.0	97.6	146.4	243.9	406.6
250	12.1	46.3	61.8	92.7	139.0	231.7	386.1
300	10.2	42.4	56.6	84.9	127.3	212.1	353.5
350	8.4	40.2	53.6	80.5	120.7	201.2	335.3
375	7.4	38.8	51.7	76.6	116.4	194.0	323.4
400	6.5	36.6	48.8	73.2	109.8	182.9	304.9
425	5.6	35.1	46.8	70.2	105.3	175.5	292.5
450	4.7	33.8	45.1	67.6	101.4	169.0	281.7
475	3.7	31.7	42.2	63.3	95.0	158.3	263.8
500	2.8	28.2	37.6	56.4	84.6	141.0	235.1
525	1.9	25.8	34.4	51.6	77.4	129.0	214.9
550	1.3)	25.0	33.3	49.9	74.9	124.8	208.0
575	—	24.1	32.1	48.2	72.3	120.5	200.8
600	—	21.4	28.6	42.9	64.3	107.2	178.6
625	—	18.3	24.3	36.5	54.8	91.3	152.1
650	—	14.1	18.8	28.2	42.4	70.6	117.7
675	—	12.6	16.8	25.3	37.9	63.2	105.3
700	—	9.9	13.3	19.9	29.8	49.7	82.9
725	—	7.7	10.3	15.4	23.1	38.5	64.2
750	—	5.9	7.8	11.0	17.6	29.4	49.0
775	—	4.6	6.1	9.1	13.7	22.8	38.0
800	—	3.5	4.7	7.0	10.5	17.5	29.2

[1] This rating is at 540°C maximum service temperature.

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Table B-2PN20 Pressure -Temperature Ratings

Gage pressures in bar

Material Group	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	I 2	3.4	3.5	3.6	3.1	3.8	Material Group
Materials → / Temp °C ↓	Carbon				½ Mo	½ Cr ½ Mo Ni-Cr Mo	1 ¼ Cr ½ Mo	2¼ Cr-1 Mo	5 Cr-½ Mo	9 Cr-1 Mo	Type 304	Type 316	Type 304 L / Type 316 L	Type 32,	Types 347 / 348	Type 309	Type 310	Cr Fe Mo Cu Cb 20Cb	Nickel Alloy 200	Ni Cu Alloys 400 405	Ni Cr Fe Alloy 600	Ni Fe Cr Alloy 800	Ni Mo Alloy B2	Alloys	← Materials / Temp °C ↓
-29 to 38	19.6	20.0	18.4	163	18.4	20.0					IV.0	19.0	15.9	19.0	19.0	17.8		15.8	9.5	15.9	19.0		20.0		38
50	19.2		18.1	16.0	18.3	19.2					18.4	18.(	15.3	18.4	18.5	17.4		15.6	9.5	15.4	18.7		19.5		50
100	17.7		17.3	14.8	17.7						15.7	16.2	13.2	15.P	16.7	15.9		14.6	9.5	13.8	173 1		7 7		100
150	15.8		15.8	14.5	15.8						13.9	14.8	12.0	14.4	15.5	15.0		13.8	P.5	12.9	15.8				150
200	14.0										12.6	13.7	11.0	132	14.0				P.5	12.6	14.0				200
250	12.1										11.7	12.1	10.2	12.1					9.5	11.9	12.1				250
300	10.2										10.2		9.7	to.2							102				300
350	8.4										a.4		a.4	a.4							a.4				350
375	7.4										7.4		7.4	7.4							7.4				375
400	6.5										63		6.5	6.5							6.5				400
425	5.6										5.6		5.6	5.6							5.6				425
450	4.1										4.1		4.1	4.1											450
475	3.1										3.7			3.7											475
500	2.8										2.8			2.8											500
525	1.9										1.9			1.0											525
540	13										1.3			13											540

NOTES

1 Ratings shown apply to other material groups where column dividing lines have been omitted

2 Provisions of Section 2 apply to all ratings.

3 *See* temperature notes for all material groups.

Table B-3 PN50 Pressure Temperature Ratings

Gauge pressures in bar

Material Group	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.4	3.5	3.6	3.7	3.8	Material Group
Materials → / Temp °C ↓	Carbon Steel				C ½ Mo	½ Cr ½ Mo Ni-Cr Mo	1 ¼ Cr ½ Mo	2¼ Cr-1 Mo	5 Cr-½ Mo	9Cr-1 Mo	Type 304	Type 316	Type 304L Type 316L	Type 321	Types 347 34.9	Type 309	Type 310	Cr-Fe-Mo-Cu-Cb 20-Cb	Ni-Cu Alloy 200	Ni-Cu Alloys 400 405	Ni-Cr-Fe Alloy 600	Ni-Cr-Fe Alloy 800	Ni-Mo Alloy B2	Nickel Alloys	← Materials / Temp °C ↓
—29 to 38	51.1	51.7	47.9	42.5	47.9	SI.7	S1.7	51.7	51.7		49.6.	49.6	41.4	49.6	49.6	46.3		41.4	24.8	41.4	49.7	49.7	51.7		38
50	50.1	51.7	47.3	41.7	47 6	SI.7	51.1	51.2	31.7		47.8	48.1	40.0	48.0	48.4	45.3		40.7	24.8	40.3	48.7	48.8	SI.7		50
100	46 4	51.5	45.1	38.6	46.6	51.5	48.8	49.0	51.5		40.9	42.2	34.5	41.5	43 5	41.4		38.1	24.8	36.1	46.1	45.4	51.5		100
150	45.2	SO.2	44.0	37.7	45.0	so.2	46.4	46.6	so.2		36.3	38.5	31.2	375	40.5	39.2		36.0	24.8	33.6	44.0	43.0	SO.2		150
200	43.8	48.8	42.1	36.6	44.2	48.8	45.5	44.8	48.8		32.a	3s.7	28.7	34.4	38.4	36.9			24.8	33.0	42.5	41.5	4a.a		200
250	41.7	46.3	40.6	34.7	43.1	46.3	44.5	442	46.3		30.5	33.4	26.7	32.1	36.2	35.1			24.8	32.8	41.1	40.2	46.3		250
300	38.7	42.4	37.7	323	42.0	42.4					29.1	31.6	25.2	305	34.4	13.4			24.8	32.8	39.9	39.7	42.4		300
350	37.0	40.2	360	30.9	40.2						28.1	30.4	24.0	293	32.9	32.0				32..8	38.8	39.1	40.2		350
375	36.5	38.8	35.3	30.9	38.8						27.8	29.7	23.6	28.9	32.2	31.4				32.8	38.2	38.6	38.8		37s
400	34.5	34.5	32.4	303	36.6						27.S	29.1	23.2	28.6	31.8	30.8				32.2	36.6				400
425	28.8	28.8	21.3	25.8	35.1				34.5	31.1	27.2	28.7	22.7	28.5	31.5	300				31.7	35.1				425
450	20.0	20.0	19.8	19.6	33.8				30.9	33.8	26.9	28.1	22.3	28.2	30.8	29.4									450
475	13.5				31.7				25.9	31.7	26.6	27.4		28.0	30.0	28.8									475
500	8.8				24.1	27.1	27.8		20.3	27.5	26.1	26.8		27.8	27.8	27.8									500
525	5.2				15.0	18.8	20.3	2L.9	15.4	22.6	23.9	25.8		2S.a	25.8	25.4	2S.a								525
550	3.3[1]				10.7"	13.9	12.8	16.4	11.7	17.0	21.8	25.0		25.0		21.8	23.6								550
575						12.4	8.5	11.7	8.8	11.2	20.1	24.1		22.8	24.1	18.5	22.0								575
600							5.9	7.6	6.5	7.2	16.7	21.4		19.8	21.4	14.5	19.4								600
625							3.4	6.6	4.5	5.0	13.1	la.3		15.8	17.8	11.4	16.6								625
650							2.3	3.7	3.0	35	10.5	14.1		125	11.6	a.0	14.1								
675											78	12.6		9.8	a.7	7.0	11.3								675
700											60	99		1.7	6.7	s.7	a.7								7m
725											4.6	77.		6.2	5.3	4.4	6.2								725
750											3.7	S.9		4.a	40	3.4	4.4								750
775											2.a	4.6		3.8	3.2	2.6	3.1								77s
800											2.1	3.5		JO	2.6	1.9	2.2								800

NOTES

1 These ratings are at 540°C maximum service temperature.

2 Ratings shown apply to other material groups where column dividing lines are omitted.

3 Provisions of Section 2 apply to all ratings.

4 *See* temperature notes for all material groups.

Table B-4 PN68 Pressure Temperature Ratings

Gage pressures in bar

Material Group	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.4	3.5	3.6	3.7	3.8	Material Group
Materials → / Temp °C ↓	Carbon Steel				C ½Mo	½Cr ½Mo Ni-Cr Mo	1 1¼ Cr ½Mo	2¼ Cr 1Mo	5Cr ½M o	9 Cr 1 Mo	Type 304	Type 316	Type 304 L Type 316 L	Type 321	Types 347 348	Type 309	Type 310	Cr-Fe Mo Cu-Cb 20-Cb	Nickel Alloy 200	Ni-Cu Alloys 400 405	Ni-Cr Fe Alloy 600	Ni-Cr Fe Alloy 800	Ni-Mo Alloy B2	Nickel Alloys	← Materials / Temp °C ↓
– 29 to 38	68.1	69.0	63.8	56.7	63.8	69.0	69.0	69.0	69.0		66.2	66.2	55.1	66.2	66.2	61.8		55.2	33.1	55.2	66.2	66.2	69.0		– 38
50	66.8	69.0	63.1	55.6	63.5	69.0	68.2	68.3	69.0		63.8	64.2	53.3	64.0	64.5	60.4		54.3	33.1	53.7	64.9	65.0	69.0		50
100	61.8	68.7	60.1	51.5	62.1	68.7	65.0	65.4	68.7		54.5	56.3	46.0	55.3	58.0	55.2		50.8	33.1	48.1	61.4	60.5	68.7		100
150	60.3	66.9	58.6	50.3	59.9	66.9	61.8	62.2	66.9		48.4	51.3	41.6	50.0	54.0	52.2		48.0	33.1	44.7	58.7	57.3	66.9		150
200	58.4	65.0	56.9	48.8	58.9	65.0	60.6	59.8	65.0		43.7	47.6	38.3	45.8	51.2	49.3			33.1	44.0	56.7	55.3	65.0		200
250	55.6	61.8	54.1	46.3	57.4	61.8	59.3	59.0	61.8		40.7	44.5	35.6	42.7	48.3	46.8			33.1	43.7	54.9	53.5	61.8		250
300	51.6	56.6	50.3	43.1	56.0	56.6					38.7	42.2	33.7	40.7	45.9	44.6			33.1	43.7	53.2	52.9	56.6		300
350	49.3	53.6	48.0	41.2	53.6						37.4	40.6	32.1	39.1	43.9	42.6				43.7	51.7	52.2	53.6		350
375	48.6	51.7	47.1	41.2	51.7						37.0	39.6	31.5	38.6	42.9	41.8				43.7	50.9	51.4	51.7		375
400	46.0	46.0	43.2	40.4	48.8						36.6	38.8	30.9	38.2	42.4	41.0				43.0	48.8				400
425	38.3	38.3	36.4	34.4	46.8				46.0	46.8	36.2	38.2	30.3	38.0	42.0	40.0				42.2	46.8				425
450	26.7	26.7	26.4	26.1	45.1				41.2	45.1	35.8	37.4	29.7	37.6	41.0	39.2									450
475	18.1				42.2				34.5	42.2	35.4	36.5		37.4	40.0	38.4									475
500	11.7				32.1	36.1	37.1		27.0	36.7	34.7	35.8		37.1	37.1	37.1									500
525	6.9				20.1	25.1	27.0	29.2	20.6	30.1	31.8	34.4		34.4	34.4	33.8	34.4								525
550	4.3[1]				14.3[1]	18.6	17.0	21.8	15.6	22.6	29.1	33.3		33.3	33.3	29.1	31.5								550
575						16.6	11.3	15.6	11.7	15.0	26.8	32.1		30.4	32.1	24.6	29.3								575
600							7.8	10.2	8.7	9.6	22.3	28.6		26.4	28.6	19.4	25.8								600
625							4.5	8.8	6.0	6.6	17.4	24.3		21.1	23.7	15.2	22.2								625
650							3.1	4.9	4.0	4.6	14.0	18.8		16.6	15.4	10.7	18.8								650
675											10.3	16.8		13.1	11.5	9.3	15.1								675
700											8.0	13.3		10.2	9.0	7.5	11.6								700
725											6.2	10.3		8.3	7.0	5.8	8.2								725
750											4.9	7.8		6.4	5.4	4.5	5.8								750
775											3.7	6.1		5.0	4.2	3.4	4.2								775
800											2.7	4.7		4.0	3.5	2.6	2.9								800

NOTES

1 These ratings are at 540°C maximum service temperature.

2 Ratings shown apply to other material groups where column dividing lines are omitted.

3 Provisions of Section 2 apply to all ratings.

4 *See* temperature notes for all material groups.

Table B-5 PN100 *Pressure Temperature Ratings*

Gage pressures in bar

Material Group / Materials → / Temp °C ↓	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.4	3.5	3.6	3.7	3.8	Material Group / Materials / Temp °C ↓
	←				C ½ Mo	½ Cr ½ Mo Ni-Cr Mo	1 1¼ Cr ½ Mo	2¼ Cr 1 Mo	5 Cr ½ Mo	9 Cr 1 Mo	Type 304	Type 310	Type 304 L Type 316 L	Type 321	Type 347 348	Type 309	Type 310	Cr Fe Mo Cu Cb 20-Cb	Nickel Alloy 200	Ni Cu Alloys 400 405	Ni Cr Fe Alloy 600	Ni Fe Cr Alloy 800	Ni Mo Alloy B2	Nickel Alloys	
− 29 to 38	102.1	103.1	95.7	85.1	95.8	103.4	103.4	103.4	103.4		99.8	99.5	82.7	99.3	99.3	92.7		82.8	49.7	82.8	99.3	99.3	103.4		− 29 to 38
50	100.2	103.1	94.6	83.4	95.3	103.4	102.3	102.4	103.4		95.7	96.3	79.9	96.0	96.8	90.7		81.4	49.7	80.6	97.4	97.6	103.4		50
100	92.8	103.1	90.2	77.2	93.2	103.1	97.5	98.1	103.1		81.8	84.4	69.0	83.0	86.0	82.8		76.2	49.7	72.1	92.1	90.7	103.1		100
150	90.5	100.4	87.9	75.4	89.9	100.4	92.7	93.3	100.4		72.7	77.0	62.5	75.0	81.0	78.4		72.1	49.7	67.1	88.0	86.0	100.4		150
200	87.6	97.6	85.4	73.1	88.4	97.6	91.0	89.7	97.6		65.5	71.3	57.4	68.7	76.8	73.9			49.7	66.0	85.0	83.0	97.6		200
250	83.4	92.7	81.2	69.4	86.2	92.7	88.9	88.4	92.7		61.1	65.8	53.4	64.1	72.4	70.2			49.7	65.6	82.3	80.3	92.7		250
300	77.5	84.9	75.4	64.6	84.1	84.9					58.1	63.3	50.5	61.1	68.9	66.9			49.7	65.5	79.9	79.3	84.9		300
350	73.9	80.5	71.9	61.9		80.5					56.1	60.8	48.1	58.7	65.8	63.9				65.5	77.6	78.3	80.5		350
375	72.9	77.6	70.6	61.7		77.6					55.5	59.4	47.2	57.8	64.4	62.7				65.5	76.3	77.2	77.6		375
400	69.0	69.0	64.8	60.6		73.2					54.9	58.2	46.3	57.3	63.5	61.5				64.5	73.2				400
425	57.5	57.5	54.6	51.6		70.2			69.0	70.2	54.3	57.3	45.4	57.0	62.9	60.0				63.3	70.2				425
450	40.1	40.1	39.6	39.2		67.6			61.8	67.6	53.7	56.2	44.5	56.4	61.5	58.8									450
475		27.1				63.3			51.8	63.3	53.1	54.7		56.0	60.0	57.6									475
500		17.6			48.1	54.1	55.6		40.5	55.0	52.1	53.7		55.6	55.6	55.6									500
525		10.4			30.1	37.6	40.5	43.8	30.8	45.2	47.8	51.6		51.6	51.6	50.8	51.6								525
550		6.5[1]			21.4[1]	27.9	25.5	32.7	23.4	34.0	43.6	49.9		49.9	49.9	43.6	47.2								550
575						24.9	17.0	23.4	17.6	22.5	40.1	48.2		45.6	48.2	37.0	43.9								575
600							11.8	15.3	13.1	14.4	33.4	42.9		39.6	42.9	29.0	38.7								600
625							8.8	13.3	9.0	9.9	26.2	36.5		31.6	35.6	22.8	32.3								625
650							4.6	7.3	6.0	7.0	21.0	28.2		25.0	23.2	16.0	28.1								650
675											15.5	25.3		19.7	17.3	14.0	21.6								675
700											12.0	19.9		15.4	13.5	11.3	17.5								700
725											9.3	15.4		12.4	10.5	9.8	12.4								725
750											7.3	11.0		9.6	8.0	6.8	9.8								750
775											5.6	9.1		7.5	6.3	5.1	6.3								775
800											4.1	7.0		6.1	5.2	3.8	4.4								800

NOTES

1 These ratings are at 540°C maximum service temperature.

2 Ratings shown apply to other material groups where column dividing lines are omitted.

3 Provisions of Section 2 apply to all ratings.

4 *See* temperature notes for all material groups.

Table B-6 PN 150 Pressure - Temperature Rating

Gage pressures in bar

Material Group	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.4	3.5	3.6	3.7	3.8	Material Group
Materials → / Temp. °C ↓	Carbon				C ½ Mo	½ Cr ½ Mo Ni-Cr-Mo	1 1¼ Cr ½ Mo	2¼ Cr 1 Mo	5 Cr-½ Mo	9 Cr-1 Mo	Type 304	Type 310	Type 304 L Type 316 L	Type 321	Types 347 348	Type 309	Type 310	Cr Fe Mo Cu Cb 20 Cb	Nickel Alloy 200	Ni Cu Alloys 400 405	Ni Cr Fe Alloy 600	Ni Fe Cr Alloy 800	Ni Mo Alloy B2	Nickel Alloys	← Materials / Temp. °C ↓
−29 to 38	153.2	155.2	143.6	127.6	143.6	15s.2	155.2	155.2	155.1		148.9	148.9		148.9	148.9	139.0		124.1	74.5	124.1	149.0	149.0	155.2		−29 to 38
50	150.2	155.2	141.9	125.2	142.9	155.2	153.4	153.6	155.1		,435	144.4		143.9	145.1	136.0		122.2	74.5	120.9	146.1	1463	155.2		50
100	139.1	154.6	135.3	115.8	139.8	154.6	1463	147.1	154.6		122.6	126.6		124.5	130.4	124.2		114.4	74.5	108.2	138.2	136.1	154.6		100
150	135.7	150.6	131.9	113.1	134.9	150.6	139.1	139.9	150.6		109.0	115.5		112.5	121.5	117.5		108.1	74.5	100.7	132.0	129.0	150.6		150
200	131.5	146.4	128.0	109.7	132.6	146.4	136.4	1345	146.4		98.3	107.0		103.1	1153	110.8			74.5	99.0	1275	1245	146.4		200
250	125.2	139.0	121.8	104.1	129.2	139.0	133.4	132.7	139.0		91.6	loo.2		96.2	108.6	1053			74.5	98.4	123.4	1205	139.0		250
300	116.2	1273	113.1	96.9	126.1	1273					87.2	94.9		91.6	103.3	100.3			74.5	98.3	119.8	119.0	1273		300
350	110.9	120.7	107.9	92.8	120.7						84.2	91.3		88.0	98.7	95.9				98.3	1163	117.4	120.7		350
375	109.4	116.4	105.9	92.6	116.4						83.3	89.1		86.8	96.6	94.1				98.3	1145	115.7	116.4		375
400	103.5	103.5	97.2	90.9	109.8						82.4	87.3		85.9	95.3	92.3				96.7	109.8				400
425	86.3	86.3	81.9	77.4			105.3		103.5	1053	81.5	86.0		85.4	94.4	90.0				95.0	1053				425
450	60.1	60.1	59.4	58.7			101.4		92.7	101.4	80.6	84.2		84.6	92.3	88.2									450
475		40.6					95.0		77.7	95.0	79.7	82.1		84.0	90.0	86.4									475
500		26.4			72.4	81.2	83.4		60.8	82.5	18.2	80.5		83.4	83.4	83.4									500
575		15.5			45.1	56.4	60.8	65.8	46.3	67.8	71.6	77.4		77.4	77.4	76.1	77.4								525
550		9.8[1)]			32.1	41.8	38.3	49.1	35.0	50.9	65.4	74.9		74.9	74.9	65.5	70.8								550
575						37.3	25.5	35.1	26.4	33.7	60.2	72.3		68.4	72.3	55.5	65.9								575
600							17.6	22.9	19.6	21.5	50.1	64.3		59.4	64.3	435	58.1								600
625							10.1	19.9	13.5	14.9	39.2	54.8		47.4	53.4	34.3	49.9								625
650							7.0	11.0	9.0	10.4	31.6	42.4		37.4	34.7	24.0	42.2								650
615											23.3	37.9		29.5	26.0	21.0	33.9								675
700											17.9	29.8		23.0	20.2	17.0	26.2								700
725											13.9	23.1		18.0	15.8	13.2	18.5								725
750											11.0	17.6		14.0	12.1	10.2	13.1								750
775											64	13.7		11.3	95	7.7	94								775
800											6.2	10.5		9.1	7.5	5.8	6.6								800

1 These ratings are at 540°C maximum service temperature.

2 Ratings shown apply to other material groups where column dividing lines are omitted.

3 Provisions of Section 2 apply to all ratings.

4 *See* temperature notes for all material groups.

Table 0.7 PN 250 Pressure -Temperature Rating

Gage pressures in bar

Material Group	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.7	3.1	3.2	3.4	3.5	3.6	3.7	3.8	Material Group
Materials → / Temp °C ↓					C ½ Mo	½ Cr-½ Mo Ni-Cr-Mo	1 1¼ Cr-½ Mo	2 ¼ Cr-1 Mo	5 Cr-½ Mo	9 Cr-1 Mo	Type 304	Type 316	Type 3 M L Type 316 L	Type 321	Types 347 348	Type 309	Type 310	Cr-Fe Mo Cu Cb 20 Cb	Nickel 200	Ni Cu Alloys 400 405	Ni Cr Fe Alloy 600	Ni Fe Cr Alloy 800	Ni Mo Alloy B2	Nickel Alloys	← Materials / Temp °C ↓
−29 to 38	255.3	258.6	239.4	212.7	239.4	258.6	258.6	258.6	258.6		248.2	248.2	206.8	248.2	248.2	231.6		206.9	124.1	206.9	2483	2483	258.6		−29 to 38
50	250.4	258.6	236.5	208.6	238.2	258.6	255.7	256.0	258.6		239.2	240.6	199.8	239.9	241.9	226.6		203.6	124.1	201.5	243.4	243.9	258.6		50
100	231 9	257.7	2255	193.1	233.0	257.7	243.8	245.2	257.7		204.4	211.0	172.4	2075	2173	207.1		190.6	124.1	180.4	230.3	226.R	257.7		100
150	226.1	251.0	219.8	188.6	224.8	251.0	231.9	233.2	251.0		181.7		156.1	1875	202.5	195.9		180.2	124.1	167.8	220.0	215.0	251.0		150
200	219.1	243.9	213.4	182.8	221.0	242.9	227.4	224.2	243.9		163.8	178.4	143.5	171.9	192.1	184.7			124.1	164.Q	2125	207.6	243.9		200
250	208.6	231.7	202.9	173.6	215.4	231.7	222.3	221.1	231.7		152.7	166.9.	133.5	160.3	181.0	175.5			124.1	164.0	205.7	2M.8	231.7		250
300	193.7	212.1	188.5	1615	210.1	212.1					1453	158.1	126.2	152.7	172.2	167.2			124.1	163.8	199.6	198.3	212.1		300
350	184.8	201.2	179.8	154.6		201.2					140.3	152.1	120.2	145.7	164.5	159.8				163.8	193.9	195.7	201.2		350
375	182.3	194.0	176.6	1543		194.0					138.8	14.35	118.0	144.6	161.0	156.8				168.8	190.8	192.9	194.0		375
400	1725	1725	162.0	151.5		182.9					1373	145.6	115.8	143.1	158.8	153.6				161.2	182.9				400
425	143.8	143.8	1365	128.9		1755			1725	175.5	135.8	143 3	113.5	142.4	1573	150.0				158.3	175.5				425
450	100.2	100.2	99.0	97.9		169.0			1545	169.0	1343	140.4	1113	141.0	153.8	147.0									450
475		67.7				158.3			1295	1583	132.8	136.8		140.1	150.0	144.0									475
500		44.0			120.3	135.3	139.0		1013	1375	130.3	134.1		139.0	139.0	139.0									500
525		25.9			75.2	94.0	1013	109.6	77.1	113.0	119.4	129.0		129.0	129.0	126.9	129.0								525
550		16.3)			53.5[1)]	69.7	63.8	81.8	58.4	84.9	109.1	124.8		124.8	124.8	109.1	118.0								5.50
575						62.2	42.5	58.5	44.1	56.2	1M.4	1205		113.9	120.5	92.4	109.9								575
600							29.4	38.2	32.6	35.9	83.6	107.2		99.0	107.2	72.6	96.8								600
625							lb.9	33.2	22.5	24.9	65.4	91.3		7v.o	89.0	57.1	83.1								625
650							11.6	18.3	ls.o	17.4	52.6	70.6		62.4	57.9	40.0	70.3								650
675											38.8	63.2		49.2	43.3	34.9	56.5								675
700											29.9	4Q.7		38.4	33.7	28.3	43.6								700
725											23.1	38.5		31.0	26.4	21.9	30.9								725
750											18.3	29.4		24 0	20.1	17.1	21.9								750
775											14.0	22.8		18.8	15.8	12.8	15.7								775
800											103	175		15.2	13.1	9 6	10.9								800

NOTES

1 These ratings are at 540°C maximum service temperature.

2 Ratings shown apply to other material groups where column dividing lines are omitted

3 Provisions of Section 2 apply to all ratings.

4 *See* temperature notes for all material groups.

Table R-8 PN 420 Pressure -Temperature Ratings

Gage pressures in bar

Material Group	1.1	1.2	1.3	1.4	1.5	1.7	1.9	1.10	1.13	1.14	2.1	2.2	2.3	2.4	2.5	2.6	2.1	3.1	3.2	3.4	3.5	3.6	3.7	3.8	Material Group
Materials → / Temp °C ↓	Carbon				C ½ Mo	½ Cr-½ Mo Ni-Cr-Mo	1 1¼ Cr-½ Mo	2¼ Cr 1 Mo	5 Cr-½ Mo	9 Cr-1 Mo	Type 304	Type 316	Type 304 L Type 316 L	Type 321	Types 347 348	Type 309	Type 310	Cr Fe Mu Cu Cb 20 Cb	Nickel Alloy 200	Ni Cu Alloys 400 405	Ni Cr Fe Alloy 600	Ni Fe Cr Alloy 800	Ni Mo Alloy B2	Nickel Alloys	← Materials / Temp °C ↓
−29 to 38	425.5	431 0	398.9	354 6	399.0	431.0	431.0	431 .0	430.9		413.6	413.6	344.6	413.6	413.6	386.1		344.8	206.9	3448	413.8	413.8	431."		-29 to 38
50	417.3	431.0	394.2	341.7	397.1	431.0	426.2	426.1	430.9		398 6	401.0	333.0	399.8	403.2	377.7		339.4	206.9	335.9	405.1	406.5	4310		50
100	386.5	429 5	375.9	321.8	388.3	4295	406.4	408.7	429.5		340.7	351.7	287.4	345.9	362.2	345.1		317.7	206.9	300.6	383.9	378.0	429.5		100
150	316 9	418.3	366.3	314.3	374.6	418.3	386.4	388.6	4183		302 8	3209	260.2	312.5	3375	326.5		300.3	206.9	279.7	366.6	358.3	418.3		150
200	365.2	406.6	355.6	304.7	368.3	406.6	379."	313.1	406.6		273.0	297.3	239.1	28615	320.2	307.9				214.9	354.2	34J.9	406.6		200
250	, 411	366.1	338 2	289.3	359.0	386.1	310.6	368.5	386.1		254.5	278.2	2225	261.2	301.7	292.6				273.3	342.9	3346	386.1		250
300	322.8	353.5	314.2	269.1	350.2	3535					242.1	263 6	210.4	2545	287.0	218.7				273.0	332.7	330.4	3535		300
350	308.0	335.3	299.1	251.7	335.3						233.8	253.8	200.4	244.5	274.2	266.3				273.0	323.2	326.2	335.3		350
375	303.9	323.4	294.3	257.2	323.4						231.3	2475	196.7	241.0	268.4	261.3				273.0	318.0	321.5	323.4		375
400	287.5	287.5	270.0	252.5	304.9						228.9	242.6	192.9	23X.6	264.7	256.3				268.7	304.9				400
425	239 6	23[2] 6	221.5	214.9	292.5				137.5	292.5	226.4	238 9	189.2	231.3	262.2	250.1				263.8	292.5				425
450	166.V	166.9	165 0	163.2	281.7				257.6	281.7	223.9	234."	185.5	234.9	256.3	245.0									450
415		112.9			263.8				215.8	263.8	221.4	228.0		2335	250.1	240.1									475
500		73.3			200.6	225.4	231.6		168.9	229.1	117.2	223.6		231.6	231.6	231.6									500
525		43.2			125.4	156.6	168.9	182.7	1285	188.3	199.0	214.9		214.9	214.9	211.5	214.9								525
550		27.2[4]			89.2"	116.1	106.4	136.4	91.3	141.5	181.8	2oa.o		208.0	208.9	181.8	196.7								550
575						103.7	70.8	97.5	73.4	93.6	167.3	200.8		189.9	200.8	154.1	183.1								575
600							49.0	63.6	54.4	59.8	139.3	118.6		165.1	178.6	221.0	161.3								600
625							28.2	55.3	37.5	41.4	109.0	152.1		131.6	148.3	95.2	138.6								625
650							19.3	30.4	25.1	29.0	87.6	117.7		104.0	96.5	66.1	117.2								650
675											64.6	1053		x1.9	72.1	58.2	94.1								675
700											49.8	x2.9		64 0	5b.1		72.7								700
725											38.5	64.1		51.6	43.9	47.8	51.5								725
750											30.4	490		40.0	33.5	28.4	36.5								750
775											13.3	38.0		31.3	2b.4	21.4	26.2								775
800											17.1	29.2		25 2	21.9	16.0	18.2								800

1 Those ratings are at 540°C maximum service for temperature.
2 Ratings shown apply to other material groups where column dividing lines are omitted.
3 Provisions of Section 2 apply to all ratings.
4 *See* temperature notes for all material groups.

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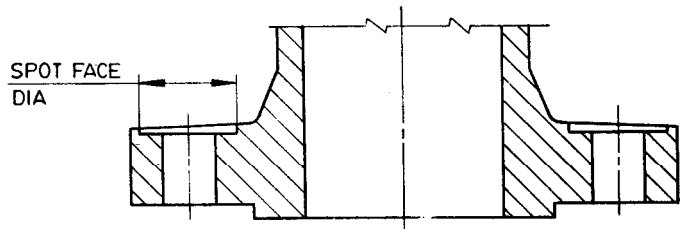
ANNEX C
(Clause 7.5)

SPOT FACING DIAMETERS



All dimensions in millimetres.

Bolt Size	Spot Face Diameters	
	Maximum	Minimum
M 14	30	29
M - 18	36	35
M - 20	41	40
M - 24	47	46
M - 27	54	52
M - 30	59	57
M - 33	64	62
M 36	70	68
M -39	76	73
M - 42	82	80
M - 45	87	84
M - 48	92	89
M 52	98	96
M 56	109	107
M - 64	122	118
M 72	133	129
M - 76	144	140
M - 90	166	162

NOTE -The spot facing shall not reduce the flange thickness below that required in the respective standards.

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